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BOSTON, U.S.A.

D. C. HEATH & CO., PUBLISHERS

1892

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EdwT 118.92.812 .

RECEIVED SEP 12 1941
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CONTENTS.

	PAGE
NOTATION AND NUMERATION	1
ADDITION	11
SUBTRACTION	22
ADDITION AND SUBTRACTION	28
MULTIPLICATION	31
DIVISION	41
REVIEW	50
CANCELLATION	53
PROPERTIES OF NUMBERS	57
FRACTIONS	62
DECIMAL FRACTIONS	83
MEASURES	94
PERCENTAGE	112
INTEREST	118
GENERAL REVIEW	126

SUGGESTIONS.

FREQUENT reviews are necessary, in order that pupils may retain principles once acquired. The exercises called "Review Work" suggest the complete system the teacher will adopt.

In Multiplication emphasize the difference in the functions of the two factors.

In Division distinguish clearly its two phases — subtractive and partitive.

Teach Cancellation as an introduction to Factors.

Drills in Factoring should be frequent and thorough.

Illustrate each operation in Fractions with objects, or with drawings, cuttings, foldings, etc.

Develop the principles in Compound Numbers by actual work with the yardstick and other common measures.

In Percentage and Interest illustrate with objective work as in Fractions.

Generally :

1. Teach facts before definitions, principles before rules.
2. In analysis encourage completeness in the chain of reasoning and accuracy of expression.
3. Insist upon neatness and orderly arrangement in the forms of written work.

INTERMEDIATE BOOK

OF

ARITHMETIC.

NOTATION AND NUMERATION.

		0	Naught	
		1	One	I
///	///	2	Two	II
///	///	3	Three	III
///	///	4	Four	IIII
///	///	5	Five	IIII I
///	///	6	Six	IIII II
///	///	7	Seven	IIII III
///	///	8	Eight	IIII IIII
///	///	9	Nine	IIII IIII I
///	///	10	Ten	IIII II
///	///	///	1	
One hundred	+	Ten	+	One = One hundred eleven
100	+	10	+	1 = III

ORAL WORK.

1. How many shoes are in a pair?
2. How many wheels has a wagon?
3. How many eggs are in a dozen?
4. How many ones, or units, are in ten?
5. How many tens are in a hundred?
6. What is the number of hours in a day?
7. How many units are in a hundred?
8. What is the number of cents in a dollar?
9. How many apples are 9 apples and 1 apple?
10. How many are 8 units and 2 units?
11. How many figures are used in writing seven units?
In writing ten units? Eleven units? Twelve units?
Fourteen units? Sixteen? Eighteen? Twenty-eight?
Thirty-nine? Sixty-nine?
12. How many units are in the largest number that can be shown by means of one figure?
13. How many units are in the largest number that can be shown by means of two figures?
14. How many units are in the smallest number that can be shown by means of three figures?
15. How many figures are in one ten and one unit? In 2 tens and 2 units? In 3 tens and 3 units? In 9 tens and 9 units? In 9 tens and 10 units?

How many units are :

6 and 5?	7 and 5?	1 ten and 1 unit ?
6 and 7?	7 and 7?	2 tens and 2 units ?
6 and 8?	7 and 9?	3 tens and 2 units ?
6 and 9?	7 and 11?	4 tens and 3 units ?
6 and 10?	8 and 9?	5 tens and 6 units ?
6 and 11?	8 and 11?	6 tens and 7 units ?
6 and 12?	8 and 12?	7 tens and 7 units ?
16 and 10?	9 and 12?	8 tens and 8 units ?
15 and 10?	9 and 14?	9 tens and 9 units ?
15 and 11?	9 and 16?	10 tens and 9 units ?

WRITTEN WORK.

1. Write in figures the number formed of 1 ten and 1 unit.
2. Write in figures the number formed of 2 tens.
3. Write 3 tens.
Write 4 tens.
Write 5 tens.
Write 6 tens.
Write 7 tens.
Write 8 tens.
Write 9 tens.
Write 10 tens.
4. Write 3 tens and 1 unit.
Write 4 tens and 2 units.
Write 5 tens and 3 units.
Write 2 tens and 4 units.
Write 4 tens and 6 units.
Write 6 tens and 5 units.
Write 7 tens and 8 units.
Write 8 tens and 9 units.
5. Write in words 21; 32; 11; 20; 43; 67; 89; 98; 56; 45; 72; 9; 0.
6. Write in figures and in words the number formed of one ten and no unit.
7. Write in figures and in words the numbers formed of:

5 units and 5 units.	8 tens and 7 units.
6 units and 6 units.	1 ten and 1 ten.
7 units and 7 units.	1 ten and 5 tens.
5 units and 6 units.	2 tens and 3 tens.
4 units and 7 units.	4 tens and 3 tens.
3 units and 8 units.	4 tens and 2 tens.
9 units and 1 unit.	5 tens and 2 tens.
9 units and 3 units.	6 tens and 1 ten.
9 units and 4 units.	6 tens and 2 tens.
8 units and 5 units.	6 tens and 3 tens.
6 units and 7 units.	3 tens and 3 tens.
5 units and 7 units.	3 tens and 5 tens.
2 units and 9 units.	2 tens and 7 tens.
3 units and 7 units.	7 tens and 1 ten.
4 units and 8 units.	8 tens and 1 ten.
6 units and 8 units.	9 tens and 0 ten.
6 units and 9 units.	9 tens and 0 unit.
9 units and 7 units.	9 tens and 1 ten.

ORAL WORK.

1. How many cents are there in 1 dime and 1 cent?
2. How many cents are there in 1 dollar and 1 cent?
3. How many dimes are there in 1 dollar?
4. How many tens are there in one hundred units?
5. How many units are in 10 tens and 1 unit?
6. How many hundreds make a thousand?
7. How many tens make a hundred units?
8. How many units are in the smallest number that can be shown with four figures?
9. How many units are in the largest number that can be shown with three figures?

How many units are :

9 tens and 9 units ?	1 hundred, 1 ten, and 1 unit ?
1 hundred and 1 ten ?	1 hundred, 0 ten, and 1 unit ?
1 hundred and 9 units ?	2 hundreds, 1 ten, and 0 unit ?
8 tens and 7 tens ?	3 hundreds, 0 ten, and 5 units ?
2 hundreds and 8 units ?	3 hundreds, 2 tens, and 0 unit ?
5 tens and 6 tens ?	3 hundreds, 2 tens, and 6 units ?
3 hundreds and 0 unit ?	4 hundreds, 0 ten, and 0 unit ?
4 hundreds and 0 ten ?	4 hundreds, 1 ten, and 0 unit ?
7 tens and 9 units ?	5 hundreds, 5 tens, and 5 units ?
9 tens and 9 tens ?	5 hundreds, 6 tens, and 7 units ?
5 hundreds and 1 hundred ?	5 hundreds, 0 ten, and 9 units ?
5 hundreds and 1 ten ?	6 hundreds, 9 tens, and 9 units ?
6 hundreds and 1 unit ?	6 hundreds, 7 tens, and 0 unit ?
7 tens and 6 units ?	6 hundreds, 0 ten, and 8 units ?
7 hundreds and 2 hundreds ?	7 hundreds, 7 tens, and 7 units ?
7 hundreds and 5 tens ?	7 hundreds, 8 tens, and 0 unit ?
7 hundreds and 5 units ?	7 hundreds, 0 ten, and 9 units ?
8 units and 5 units ?	8 hundreds, 9 tens, and 9 units ?
8 tens and 5 tens ?	9 hundreds, 0 ten, and 9 units ?
8 hundreds and 1 hundred ?	9 hundreds, 9 tens, and 0 unit ?
9 hundreds and 1 hundred ?	9 hundreds, 9 tens, and 9 units ?

WRITTEN WORK.

Write in figures :

One thousand.	Four thousand ten.
One thousand one.	Four thousand nineteen.
One thousand two.	Four thousand ninety.
One thousand ten.	Five thousand eleven.
One thousand eleven.	Five thousand sixty.
One thousand twenty.	Five thousand seventeen.
One thousand thirty-one.	Six thousand fifty-five.
One thousand forty-two.	Six thousand ninety-two.
One thousand fifty-three.	Six thousand one.
One thousand sixty-four.	Six thousand twenty.
One thousand seventy-five.	Seven thousand eleven.
One thousand eighty-eight.	Seven thousand thirty.
One thousand ninety-nine.	Eight thousand ten.
Two thousand ninety.	Eight thousand one.
Three thousand eleven.	Eight thousand seventy.
Three thousand ninety-nine.	Nine thousand nine.
Four thousand one.	Nine thousand ninety.
One thousand one hundred eleven.	
Two thousand one hundred nine.	
Two thousand three hundred one.	
Three thousand nine hundred ninety.	
Four thousand three hundred ten.	
Five thousand five hundred fifty-two.	
Five thousand nine hundred forty.	
Six thousand three hundred six.	
Seven thousand seven hundred ten.	
Seven thousand nine hundred nine.	
Seven thousand eight hundred twenty-six.	
Eight thousand nine hundred twenty.	
Eight thousand thirty-seven.	
Eight thousand two hundred twenty.	
Nine thousand nine hundred.	
Nine thousand nine hundred nine.	

Write in words :

301	11	0	204
3001	101	1101	3007
2010	310	2110	3100
4101	4150	3609	4650
5217	4011	3717	4999
5009	5110	3004	5000
5100	5201	4100	6999
5390	6130	506	8001
107	4707	7020	9999
5211	4770	4111	10001

Write in figures the numbers formed of :

1. 2 thousands and 4 units.
2. 3 thousands and 4 units.
3. 3 thousands and 9 units.
4. 9 hundreds and 3 tens.
5. 9 tens and 9 units.
6. 1 thousand and 1 ten.
7. 2 thousands and 9 tens.
8. 3 hundreds and 8 tens.
9. 4 thousands and 6 units.
10. 4 tens and 6 units.
11. 5 hundreds and 5 tens.
12. 5 thousands and 5 units.
13. 6 thousands and 6 tens.
14. 6 hundreds and 6 units.
15. 7 thousands and 5 tens.
16. 7 hundreds and 7 units.
17. 8 thousands and 1 unit.
18. 8 hundreds and 9 tens.
19. 9 tens and 0 unit.
20. 9 hundreds and 1 unit.
21. 9 thousands, 9 hundreds, 9 tens, and 0 unit.
22. 8 thousands, 9 hundreds, and 9 units.
23. 1 thousand, 1 hundred, and 0 unit.
24. 2 thousands, 3 hundreds, and 3 tens.
25. 4 thousands, 2 hundreds, 2 tens, and 9 units.
26. 5 thousands, 2 tens, and 6 units.
27. 6 thousands, 1 hundred, and 9 tens.
28. 5 thousands, 1 hundred, 1 ten, and 1 unit.
29. 3 thousands, 3 tens, and 7 units.
30. 2 thousands, 9 hundreds, and 9 tens.
31. 6 thousands, 8 hundreds, and 4 units.
32. 7 thousands and 7 units.
33. 7 thousands and 8 tens.
34. 7 thousands, 7 hundreds, and 6 units.

35. Eight thousands, eight tens, and four units.
36. Nine thousands, nine hundreds, and one unit.
37. Nine thousands and three tens.
38. Nine thousands, nine tens, and nine units.
39. Nine thousands, nine hundreds, and no unit.
40. Nine thousands, nine hundreds, nine tens, and nine units.

Ten units make one ten.

Ten tens make one hundred.

Ten hundreds make one thousand.

Ten thousands make one ten-thousand.

Ten ten-thousands make one hundred-thousand.

Ten hundred-thousands make one million.

Ten millions make one ten-million.

Ten ten-millions make one hundred-million.

Ten hundred-millions make one billion.

-
41. Ten thousands, five hundreds, and one ten.
 42. Twenty thousands and one unit.
 43. Thirty-five thousands, three hundreds, and seven units.
 44. Forty thousands, five hundreds, nine tens, and one unit.
 45. Fifty-five thousands and six tens.
 46. Sixty-one thousands and six hundreds.
 47. Seventy thousands, two hundreds, and two units.
 48. Eighty-seven thousands and nine tens.
 49. Ninety-nine thousands, nine hundreds, and nine tens.
 50. One hundred-thousand.
 51. One hundred-thousand, two hundreds, and five units.
 52. Six hundred fifty thousands, nine hundreds, and two tens.
 53. Seven hundred ninety-five thousands and five hundreds.
 54. Nine hundred-thousands and seven units.

55. Nine hundred ninety thousands and four tens.
 56. One million, one hundred-thousand, and six units.
 57. One hundred-thousand, one ten-thousand, and one ten.
 58. Three hundred-thousands and three ten-thousands.
 59. Three millions, two hundred-thousands, and one ten.

DEFINITIONS.

Unit means one.

Notation is writing numbers.

Numeration is reading numbers.

In Arabic Notation the value of a character is determined by the number of figures to the right of it.

If 9 has no figure to its right, its value is nine. If it has one figure to its right, its value is ninety, as in 95 or in 90. In the expression 90, the 0 is of no service except to push the 9 one place to the left. If 9 has two figures to its right, its value is nine hundred, as in 956 or in 900. In 956 the 6 is said to be in the first order of units, the 5 in the second order of units, and the 9 in the third order of units.

A **Period** consists of three *orders* — units, tens, and hundreds.

The first period is the period of units, the second is the period of thousands, the third is the period of millions, and so on.

4th Period.	3d Period.	2d Period.	1st Period.
BILLIONS.	MILLIONS.	THOUSANDS.	UNITS.
HUNDREDS TENS UNITS	HUNDREDS TENS UNITS	HUNDREDS TENS UNITS	HUNDREDS TENS UNITS
5 4 3,	2 1 7,	3 4 2,	1 2 3

Five hundred forty-three billion, two hundred seventeen million, three hundred forty-two thousand, one hundred twenty-three.

ROMAN NOTATION.

Seven capital letters are used in **Roman Notation**.

I	V	X	L	C	D	M
One	Five	Ten	Fifty	One hundred	Five hundred	One thousand

Repeating a letter repeats its value.

II is 2, III is 3, XX is 20, XXX is 30, CCC is 300, MM is 2000. V and L are never repeated.

Three repetitions of a letter are not commonly used. To write 4, the letter V is employed with the letter I to the left, which means *one less than five*. To write 9, the letter X is employed, with the letter I to the left, meaning one less than ten. To write 40, the letters XL are employed, meaning ten less than fifty. 90 is written XC, meaning ten less than one hundred. 400 is written CD, meaning one hundred less than five hundred. 900 is written CM, meaning one hundred less than one thousand.

When a letter of less value is to the left of a letter of greater value, the value of the greater letter is lessened by the value of the letter to its left.

Roman Notation is used for such purposes as numbering the hours on clocks and watches, and for numbering volumes, chapters, divisions of subjects, etc.

THE VALUES OF THE LETTERS.

From 1 to 10.	From 11 to 20.	From 21 to 30.	From 31 to 40.
I	XI	XXI	XXXI
II	XII	XXII	XXXII
III	XIII	XXIII	XXXIII
IV	XIV	XXIV	XXXIV
V	XV	XXV	XXXV
VI	XVI	XXVI	XXXVI
VII	XVII	XXVII	XXXVII
VIII	XVIII	XXVIII	XXXVIII
IX	XIX	XXIX	XXXIX
X	XX	XXX	XL

From 41 to 50.	From 51 to 60.	From 71 to 80.	From 91 to 100.
XLI	LI	LXXI	XCI
XLII	LII	LXXII	XCII
XLIII	LIII	LXXIII	XCIII
XLIV	LIV	LXXIV	XCIV
XLV	LV	LXXV	XCV
XLVI	LVI	LXXVI	XCVI
XLVII	LVII	LXXVII	XCVII
XLVIII	LVIII	LXXVIII	XCVIII
XLIX	LIX	LXXIX	XCIX
L	LX	LXXX	C

Write in figures:

CIV	CCXLI	CCCXXXIX
CX	CCXXIX	CMLXXXIV
CXIV	CCCIV	MCIX
CLX	CCCLXIX	MCCXLVIII
CXL	CCCXC	MCCCIX
CIX	CD	MDXXXIX
CXC	CDIX	MCD
CCXI	CDXLIV	MCDXC
CVI	CDXCIV	MCDIV
CLIV	CM	MDCCCXIII

Write in Roman :

159	769	877
328	2149	1716
409	1949	1893
1300	1492	1732
1009	999	1776
2010	1001	1836

ADDITION.

ORAL WORK.

1. How many kites are 4 kites and 2 kites? 4 kites and 3 kites? 4 kites and 4 kites? 4 kites and 5 kites?

2. How many stars are 5 stars and 5 stars? 5 stars and 6 stars? 5 stars and 7 stars? 5 stars and 8 stars?

3. How many roses are 5 roses and 9 roses? 6 roses and 9 roses? 7 roses and 9 roses? 8 roses and 9 roses?

4. A laborer earned 7 dollars one week and 8 dollars the next week; how much did he earn in both weeks? How many are 8 and 7? 7 and 8?

5. How many tens are 8 tens and 6 tens? 7 tens and 6 tens? 9 tens and 8 tens? 9 tens and 9 tens?

6. John lives 9 miles east of the college, and James lives 10 miles west of the college; how many miles from John's home to James's? How many are 10 and 9?

7. Richard shelled 10 bushels of corn in the forenoon and 10 bushels in the afternoon; how many bushels did he shell in the day? How many are 10 and 10?

8. Helen bought 15 yards of ribbon for her sewing society, and Alice bought 6 yards; how many yards did both buy? How many are 15 and 6?

9. A farmer has 15 acres in oats and 7 acres in wheat; how many acres in the two kinds of grain? How many are 15 and 7?

10. How many acres are 15 acres and 8 acres? 15 acres and 9 acres? How many are 15 and 10?

Addition is the process of finding the number of units in two or more numbers.

The whole number of units in two or more numbers is called their **Sum**. The sign of addition (+) is read *plus*.

WRITTEN WORK.

	4	5	6	8	10	12	14	24
1. Add	5	6	7	9	9	12	14	11
	—	—	—	—	—	—	—	—

2. Mr. Smith sold 8 pounds of sugar to one customer, and 9 pounds to another; how many pounds did he sell to the two?

	2	4	3	2	4	3	2	3
	3	3	1	2	4	3	6	6
3. Add	3	5	6	7	3	4	3	4
	—	—	—	—	—	—	—	—

4. A picnic party spent 3 hours in going to the woods, 5 hours in the woods, and 3 hours in returning home; how many hours in all?

5. A foot-rule is 12 inches long; a yard stick is 24 inches longer; how many inches long is a yard stick?

6. In one week a Jersey cow gave 21 gallons of milk; the next week she gave 18 gallons; how many gallons did she give in the two weeks?

7. The first week of school there were present 23 girls and 24 boys; how many pupils?

8. A fruit-dealer sold to one boy 8 oranges, to another 3 oranges, and to another 5 oranges; how many oranges did the three boys buy?

9. Henry lives 12 blocks east of the post-office, and Fred lives 14 blocks west of the post-office; how many blocks from Henry's to Fred's?

10. Last year Mr. Roberts sowed 26 bushels of wheat; this year he sowed 13 bushels more than he did last year; how many bushels did he sow this year?

11. James has 17 marbles; if he should buy 12 more, how many would he then have?

12. Washington was 23 years old at the time of Braddock's defeat; he died 44 years afterward; what was his age at his death?

ADDITION.

13

13.	14.	15.	16.	17.	18.	19.	20.
5	7	6	9	7	6	7	8
4	2	4	8	9	7	2	5
6	1	7	7	6	4	8	4
3	8	8	5	5	2	3	9
2	4	9	6	8	1	5	7
9	7	7	4	3	7	9	2
8	6	6	3	4	6	3	3
7	8	5	8	9	3	7	8
8	3	8	5	7	8	8	5
6	9	3	7	5	4	5	4
4	5	4	9	4	2	6	9
2	6	5	6	7	9	8	7
—	—	—	—	—	—	—	—

21.	22.	23.	24.	25.	26.	27.	28.
12	14	26	33	21	40	51	62
13	10	21	44	32	29	27	33
24	15	11	12	53	30	20	14
—	—	—	—	—	—	—	—

29.	30.	31.	32.	33.	34.	35.	36.
7	6	5	8	9	4	3	4
6	5	9	9	8	9	8	7
7	6	5	8	7	8	9	9
5	4	8	8	9	4	3	6
7	6	5	7	7	7	9	9
4	3	7	8	8	9	8	2
7	6	5	6	9	8	7	3
3	2	6	8	6	4	3	8
7	6	5	5	7	6	9	5
2	9	4	8	9	7	8	7
7	6	5	4	5	9	6	6
9	8	7	8	7	8	9	9
7	6	5	3	9	4	3	5
8	7	8	8	6	5	4	8
7	6	5	2	9	9	9	4
7	7	3	8	7	8	6	9
4	3	7	9	8	7	5	7
—	—	—	—	—	—	—	—

ORAL WORK.

1. How many are $2 + 2 + 2 + 2 + 2$?
2. How many are $3 + 3 + 3 + 3 + 3$?
3. Begin with 2 and add by twos to 24.
4. Begin with 3 and add by threes to 36.
5. Begin with 4 and add by fours to 48.
6. Begin with 5 and add by fives to 60.
7. Begin with 6 and add by sixes to 72.
8. Begin with 7 and add by sevens to 84.
9. Begin with 8 and add by eights to 96.
10. Begin with 9 and add by nines to 108.

Tell the sums :

	$\begin{array}{r} 7 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 27 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 37 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 47 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 57 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 67 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 77 \\ 6 \\ \hline \end{array}$
11.								
	$\begin{array}{r} 7 \\ 17 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 37 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 47 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 57 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 67 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 77 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 87 \\ \hline \end{array}$
12.								
	$\begin{array}{r} 18 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 28 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 48 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 68 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 78 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 88 \\ 5 \\ \hline \end{array}$
13.								
	$\begin{array}{r} 28 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 48 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 68 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 78 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 88 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 98 \\ 9 \\ \hline \end{array}$
14.								
	$\begin{array}{r} 8 \\ 26 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 36 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 46 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 56 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 66 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 76 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 86 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 96 \\ \hline \end{array}$
15.								
	$\begin{array}{r} 29 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 39 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 49 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 59 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 69 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 79 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 89 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 99 \\ 7 \\ \hline \end{array}$
16.								
	$\begin{array}{r} 8 \\ 29 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 49 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 59 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 69 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 79 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 89 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ 99 \\ \hline \end{array}$
17.								

ADDITION.

15

	27	37	47	57	67	77	87	97
18.	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>
	9	9	9	9	9	9	9	9
19.	<u>16</u>	<u>26</u>	<u>36</u>	<u>46</u>	<u>56</u>	<u>66</u>	<u>76</u>	<u>86</u>
	18	28	38	48	58	68	78	88
20.	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>

WRITTEN WORK.

1. Add 4 174, 2 863, and 7 295.

EXPLANATION.

I. Write the numbers in columns of units, tens, hundreds, and thousands. 4 174
2 863

II. Find the sum of the right-hand or units' column, thus: 7 295
5, 8, 12—12 units. The 12 units are 1 ten and 2 units. 14 332

III. Place the 2 units under the units' column; then to the tens' column add the 1 ten taken from the 12 units, thus: 1, 10, 16, 23—23 tens. The 23 tens are 2 hundreds and 3 tens.

IV. Place the 3 tens under the tens' column; then to the column of hundreds add the 2 hundreds taken from the 23 tens, thus: 2, 4, 12, 13—13 hundreds. The 13 hundreds are 1 thousand and 3 hundreds.

V. Place the 3 hundreds under the hundreds' column; then to the column of thousands add the 1 thousand taken from the 13 hundreds, thus: 1, 8, 10, 14—14 thousands. The 14 thousands are 1 ten-thousand and 4 thousands.

VI. Place the 4 thousands under the thousands' column, and the 1 ten-thousand in the ten-thousands' place.

2. A merchant has three clerks; to one he pays 125 dollars per month, to another 95 dollars per month, and to the third 75 dollars per month; how much to the three?

Ans. \$ 295.

3. A farmer has five fields; in the first there are 37 acres; in the second, 48 acres; in the third, 51 acres; in the fourth, 79 acres; and in the fifth, 160 acres; how many acres in the five fields?

Ans. 375 A.

4. In publishing a daily newspaper in February, the following quantities of paper were used: for the first week, 117 tons; the second week, 98 tons; the third week, 136 tons; the fourth week, 159 tons; how many tons of paper were used in the four weeks? *Ans.* 510 T.

5. How many days are in the first seven months of a common year? *Ans.* 212 da.

6. A nurseryman sold one week 756 pear-trees, 1 598 apple-trees, 589 peach-trees, and 179 cherry-trees; how many trees in all? *Ans.* 3 122 trees.

7. A bookseller's sales for one week were as follows: on Monday, \$297; on Tuesday, \$219; on Wednesday, \$275; on Thursday, \$258; on Friday, \$163; on Saturday, \$342. Find amount of his week's sales. *Ans.* \$1 554.

8. On the north side of a library there are 2 475 books; on the east side, 3 729 books; on the south side, 3 467 books; on the west side, 1 249 books; how many books on the four sides? *Ans.* 10 920 books.

9. From Galveston to St. Louis is 870 miles; from St. Louis to Chicago is 286 miles; from Chicago to New York is 961 miles; how many miles does a Galveston merchant travel in going to New York via St. Louis and Chicago? *Ans.* 2 117 mi.

10. Find the entire cost of building a house from the amounts here given:

Brick and stone,	\$ 275;	Carpenter work,	\$ 650;
Lumber,	726;	Mason work,	184;
Other material,	318;	Painting etc.,	345.

Ans. \$2 498.

11. The area of Florida is 58 680 square miles; of Alabama, 52 250 square miles; of Mississippi, 46 810 square miles; of Louisiana, 48 720, and of Texas, 265 780 square miles; how many square miles in the five Gulf states?

Ans. 472 240 sq. mi.

REVIEW WORK.

The whole of the last page of written work in Arabic Notation and Numeration.

12. A farmer's expenses in 1892 were : for labor, \$387 ; for corn, \$126 ; for implements, \$95 ; for 1 mule, \$115 ; for family and other expenses, \$567 ; find the total.

Ans. \$1 290.

13. A capitalist received last year from rent of houses, \$2 375 ; from railroad investments, \$5 780 ; from mining stock, \$3 628 ; from all other sources, \$4 276 ; find his total income.

Ans. \$16 059.

14. Columbus's first voyage was in 1492 ; Jamestown was settled 115 years afterward ; from the settlement of Jamestown to the surrender of Cornwallis was 174 years ; in what year did Cornwallis surrender?

Ans. 1781.

15. E. Raphael, manager Houston Clearing House, reports the following bank movement for the past week :

1892. Monday, February 29,	\$ 781 521
Tuesday, March 1,	758 350
Wednesday, March 2, (<i>Holiday</i>)	
Thursday, March 3,	964 785
Friday, March 4,	574 984
Saturday, March 5,	862 519
Total,	<hr/> \$ × × × × ×.

16. If, in the problem above, the banks had not been closed on Texas Independence Day, and there had been included for March 2, \$879 987, what would have been the total for the week?

Ans. \$4 822 146.

17. The paying attendance at a fair for six days was :

Monday, 12 317 ;	Thursday, 23 586 ;
Tuesday, 19 469 ;	Friday, 18 324 ;
Wednesday, 15 217 ;	Saturday, 29 753.

Saturday was " Children's Day," and the non-paying attendance was estimated at 4 500 ; find total as estimated.

Ans. 123 166.

18. A farmer made 10 *B/C* weighing as follows :

#1. 568 ; #2. 496 ; #3. 521 ; #4. 490 ; # 5. 492 ;
#6. 515 ; #7. 503 ; #8. 486 ; #9. 476 ; #10. 450 ;

find the weight of the 10 *B/C*.

Ans. 4 997 lb.

19.	20.	21.	22.	23.	24.
478	379	987	577	871	569
595	956	778	796	796	278
616	785	695	978	659	965
973	977	348	465	884	798
868	466	795	798	774	643
<u>255</u>	<u>985</u>	<u>688</u>	<u>653</u>	<u>669</u>	<u>899</u>

25. Find the totals of all the columns above, and add these totals for a new total, or aggregate. *Ans.* 25 696.

26.	27.	28.	29.	30.	31.
1 072	987	1 456	5 409	4 297	3 799
2 986	6 542	2 987	3 986	2 974	6 654
5 439	3 988	3 798	2 757	7 929	9 587
8 767	2 756	2 565	1 986	6 576	8 656
7 998	2 689	3 878	2 465	5 895	7 968
<u>5 475</u>	<u>4 557</u>	<u>6 547</u>	<u>1 778</u>	<u>8 658</u>	<u>5 495</u>

32. Find the aggregate of the columns 26-31.

Ans. 171 356.

33.	34.	35.	36.	37.	38.
9 579	8 765	7 999	6 598	7 789	5 697
8 865	9 876	8 654	5 798	6 954	7 987
7 978	7 998	6 987	6 987	9 678	6 559
6 569	5 679	5 768	4 879	8 795	9 778
7 897	9 547	9 876	9 765	7 867	8 866
<u>4 579</u>	<u>4 896</u>	<u>7 599</u>	<u>7 656</u>	<u>5 549</u>	<u>4 998</u>

39. Find the aggregate of the columns 33-38.

Ans. 271 311.

40.	41.	42.	43.	44.	45.
76 238	94 987	49 976	65 198	73 902	83 569
95 965	67 876	96 789	76 209	68 498	38 876
79 878	78 569	55 678	97 965	79 965	96 768
65 763	55 879	96 309	86 876	67 688	55 976
48 688	86 387	87 516	75 967	86 753	76 575
<u>79 766</u>	<u>59 656</u>	<u>76 688</u>	<u>49 374</u>	<u>97 868</u>	<u>49 984</u>

46. Find the aggregate of columns 40-45.

Ans. 2 680 619.

47.	48.	49.	50.
16 143	33 161	50 253	67 352
17 116	34 236	51 279	68 389
18 105	35 165	52 257	69 576
19 143	36 238	53 281	70 467
2 022	37 169	54 278	711 679
2 132	38 239	55 276	72 597
22 275	39 172	56 291	732 679
23 265	40 242	57 299	742 678
24 243	41 244	58 299	752 799
25 125	42 183	59 302	76 787
26 245	43 246	60 298	772 877
27 126	44 254	61 279	78 897
28 232	45 247	62 364	792 877
29 157	46 274	63 363	80 999
30 234	47 249	64 299	813 001
31 234	48 277	65 277	823 497
<u>32 235</u>	<u>49 252</u>	<u>66 279</u>	<u>83 879</u>
51.	52.	53.	54.
604 819	7 765 863	94 125	1 113 375
6 117 172	7 874 593	95 216	1 123 600
6 240 779	7 953 399	96 252	1 134 096
6 333 968	8 059 204	97 343	1 144 352
6 419 602	8 175 563	98 392	1 154 913
6 514 694	8 269 204	99 512	1 165 202
6 644 832	8 365 892	100 576	1 175 832
6 720 562	8 465 593	101 729	1 186 156
6 827 744	8 578 763	102 891	1 196 498
6 934 539	8 674 404	1 031 331	1 209 261
7 037 362	8 766 263	1 041 452	12 111 132
7 145 396	8 875 848	1 051 728	12 213 824
7 237 841	891 536 462	1 061 872	12 315 625
7 356 163	902 029 531	1 072 197	12 411 016
7 444 951	917 527 741	1 082 366	12 564 296
7 552 061	925 967 731	1 092 744	126 278 712
<u>7 660 751</u>	<u>937 863 684</u>	<u>1 102 940</u>	<u>127 635 460</u>

55. March 4, 1892, the stocks of cotton reported in New Orleans, New York, Memphis, and St. Louis were, respectively, 432 782, 393 717, 139 559, 137 463 bales; find the total in the four cities. *Ans. 1 103 521 B/C.*

56. RECEIPTS OF COTTON AT NEW ORLEANS, LA., via the Louisville, New Orleans, and Texas Railway :

Month.	1886-7.	1887-8.	1888-9.	1889-90.	1890-1.	1891-2.
Sept.	5 715	27 556	5 968	18 755	17 959	26 633
Oct.	45 001	79 915	57 085	95 788	72 241	103 104
Nov.	63 511	77 256	81 350	102 565	76 892	105 616
Dec.	85 668	75 433	89 897	77 877	92 015	87 057
Jan.	72 917	40 005	38 727	70 444	77 876	71 226
Feb.	31 749	34 386	22 383	38 745	34 164	74 009
Totals						

(a) From the totals find the aggregate. *Ans. 2 177 488 B/C.*

(b) Find the Sept. receipts for the 6 years. *Ans. 102 586 "*

(c) Find the Oct. " " " " " *Ans. 453 134 "*

(d) Find the Nov. " " " " " *Ans. 507 190 "*

(e) Find the Dec. " " " " " *Ans. 507 947 "*

(f) Find the Jan. " " " " " *Ans. 371 195 "*

(g) Find the Feb. " " " " " *Ans. 235 436 "*

(h) Prove the aggregate (a) by adding b, c, d, e, f, g.

57. Bushels of grain received Feb. 25, 1892:

Receipts in	Wheat.	Corn.	Oats.	Totals.
Chicago	67 202	168 583	164 789	xxx xxx
Milwaukee	51 000	4 060	13 000	xx xxx
Minneapolis	304 800	000	000	xxx xxx
Duluth	97 314	000	000	xx xxx
St. Louis	39 000	177 000	27 000	xxx xxx
Toledo	12 620	8 090	1 300	xx xxx
Detroit	32 238	9 259	5 704	xx xxx
New York	172 500	69 750	42 025	xxx xxx
Baltimore	54 289	139 424	10 000	xxx xxx
Philadelphia	25 248	160 267	33 822	xxx xxx
Boston	44 005	26 305	50 535	xx xxx
Totals	xxx xxx	xxx xxx	xxx xxx	xxx xxx

58. Six freight cars were loaded with cotton-bales :

The first, numbered	156,	had	40	B/C,	weighing	19 357 lb.
The second, "	1 698,	"	38	"	"	18 576 lb.
The third, "	9 742,	"	34	"	"	17 485 lb.
The fourth, "	28 001,	"	41	"	"	19 572 lb.
The fifth, "	3 709,	"	39	"	"	18 948 lb.
The sixth, "	16 557,	"	40	"	"	19 359 lb.

Add the numbers on the cars.

Ans. 59 863.

How many B/C on the six cars ?

Ans. 232 B/C.

Find the total weight of cotton.

Ans. 113 297 lb.

59. Enrolment in the public schools of 20 counties :

1892.	WHITE.		COLORED.		Totals.
	Boys.	Girls.	Boys.	Girls.	
Brown	1 451	1 466	8	7	x x x x
Clay	977	976	15	31	x x x x
Fayette	2 852	2 800	1 688	1 634	x x x x
Franklin	645	646	101	78	x x x x
Hamilton	1 191	1 026	2	0	x x x x
Harrison	1 016	930	2 809	2 729	x x x x
Jackson	169	135	222	256	x x x
Jasper	402	384	400	421	x x x x
Jefferson	434	438	450	471	x x x x
Lee	1 012	961	512	512	x x x x
Liberty	303	275	250	252	x x x x
Madison	831	772	245	226	x x x x
Marion	441	425	1 433	1 464	x x x x
Montgomery	851	795	925	883	x x x x
Newton	399	345	254	244	x x x x
Polk	840	786	577	527	x x x x
Smith	1 935	1 859	2 068	2 104	x x x x
Taylor	929	878	12	18	x x x x
Tyler	1 389	1 044	524	398	x x x x
Washington	1 670	1 515	2 133	2 152	x x x x
Totals	x x x x x	x x x x x	x x x x x	x x x x x	67 228

SUBTRACTION.



ORAL WORK.

1. Lucy had 3 peaches, and ate all but 1; how many peaches did she eat?

2. A newsboy had 10 papers, and sold all but 2; how many did he sell?

3. A drover had 400 hogs, and sold all but 100; how many did he sell?

4. Frank paid 80 dollars for a bicycle, and sold it for 60 dollars; how much did he lose?

5. Of the 90 pupils in school 40 are boys; how many girls?

6. How many more days are there in January than in Christmas week?

7. What is the difference between the values of a 25-cent piece and a 50-cent piece?

8. Mary was born in the year 1883; how old is she?

9. What number must be added to 22 to make 36?

10. How many years ago did Columbus discover America?

11. How much less than 16 dollars is 7 dollars?

12. If James had 9 more turkeys he would have 17; how many turkeys has he?

Subtraction is the process of finding the difference between two numbers.

The number to be lessened is called the **Minuend**.

The number to be subtracted is called the **Subtrahend**.

The result obtained is called the **Difference**, or **Remainder**.

The sign of **Subtraction** ($-$) is read *minus*.

WRITTEN WORK.

	9	8	9	7	44	87
1. Subtract	5	4	6	3	22	53
	—	—	—	—	—	—

2. Mr. Jones has 40 acres in wheat and 56 acres in corn; how many more acres has he in corn than in wheat?

3. What is the difference between the length of a railroad that is 879 miles long, and the length of another railroad 358 miles long? *Ans.* 521 mi.

4. From a herd of 938 head of cattle Mr. Franklin shipped 417 head to Chicago; how many cattle remained in the herd? *Ans.* 521 head.

5. How many years was it from De Soto's discovery of the Mississippi river in 1541, to the admission of Texas in 1845? *Ans.* 304 yr.

6. A farmer raised 786 bushels of corn; finding that 520 bushels would be enough for his own use, he sold the surplus; how many bushels did he sell? *Ans.* 266 bu.

7. March 4 New Orleans received by the Southern Pacific Railway 1 899 *B/C*, and by the Texas and Pacific 897 *B/C*; how many bales more were received by the S. P. than by the T. & P.? *Ans.* 1 002 *B/C*.

8. On the same day Chicago received 164 789 bu. oats, and New York 42 025 bu. oats; how many bushels more did Chicago receive than New York? *Ans.* 122 764 bu.

9. From one million nine hundred eighty-seven thousand six hundred sixty-two, subtract five hundred twenty thousand two hundred one. *Ans.* 1 467 461.

10. What number must be added to 3 265 to make 6 596? *Ans.* 3 331.

11. What number subtracted from 76 982 will leave 45 901? *Ans.* 31 081.

12. Find the difference in pounds between a cargo weighing 399 597 lb., and another weighing 287 163 lb. *Ans.* 112 434 lb.

13. Subtract 1 437 from 2 356.

EXPLANATION.

I. Below the minuend, write the subtrahend, units under units, tens under tens, etc.

II. From the 6 units, the 7 units cannot be subtracted; changing into units 1 ten of the 5 tens of the minuend, the units of the minuend become 16, and the tens of the minuend become 4. Subtract 7 units from 16 units, and place the difference, 9 units, below.

$$\begin{array}{r} 2\ 356 \text{ Minuend.} \\ 1\ 437 \text{ Subtrahend.} \\ \hline 919 \text{ Remainder.} \end{array}$$

III. Subtract the 3 tens of the subtrahend from the 4 tens of the minuend, and place the difference, 1 ten, below.

IV. From 3 hundreds, 4 hundreds cannot be subtracted; changing into hundreds 1 thousand of the 2 thousands of the minuend, the hundreds of the minuend become 13, and the thousands of the minuend become 1. Subtract 4 hundreds from 13 hundreds, and place the difference, 9 hundreds, below.

V. Subtract the 1 thousand of the subtrahend from the 1 thousand of the minuend, and nought remains.

$$\begin{array}{r} 14. \text{ Subtract} \quad \begin{array}{r} 337 \\ 193 \\ \hline \end{array} \quad \begin{array}{r} 462 \\ 159 \\ \hline \end{array} \quad \begin{array}{r} 541 \\ 238 \\ \hline \end{array} \quad \begin{array}{r} 1\ 652 \\ 981 \\ \hline \end{array} \quad \begin{array}{r} 447 \\ 352 \\ \hline \end{array} \end{array}$$

$$\begin{array}{r} 15. \text{ Subtract} \quad \begin{array}{r} 1\ 516 \\ 734 \\ \hline \end{array} \quad \begin{array}{r} 350 \\ 149 \\ \hline \end{array} \quad \begin{array}{r} 7\ 642 \\ 1\ 939 \\ \hline \end{array} \quad \begin{array}{r} 5\ 293 \\ 1\ 968 \\ \hline \end{array} \quad \begin{array}{r} 6\ 041 \\ 3\ 827 \\ \hline \end{array} \end{array}$$

$$\begin{array}{r} 16. \text{ Subtract} \quad \begin{array}{r} 5\ 171 \\ 3\ 929 \\ \hline \end{array} \quad \begin{array}{r} 4\ 265 \\ 3\ 947 \\ \hline \end{array} \quad \begin{array}{r} 6\ 741 \\ 2\ 832 \\ \hline \end{array} \quad \begin{array}{r} 5\ 182 \\ 4\ 917 \\ \hline \end{array} \quad \begin{array}{r} 6\ 243 \\ 5\ 716 \\ \hline \end{array} \end{array}$$

$$\begin{array}{r} 17. \text{ Subtract} \quad \begin{array}{r} 5\ 409 \\ 3\ 216 \\ \hline \end{array} \quad \begin{array}{r} 2\ 470 \\ 1\ 666 \\ \hline \end{array} \quad \begin{array}{r} 4\ 271 \\ 1\ 758 \\ \hline \end{array} \quad \begin{array}{r} 3\ 261 \\ 1\ 656 \\ \hline \end{array} \quad \begin{array}{r} 5\ 192 \\ 3\ 726 \\ \hline \end{array} \end{array}$$

$$\begin{array}{r} 18. \text{ Subtract} \quad \begin{array}{r} 3\ 927 \\ 2\ 867 \\ \hline \end{array} \quad \begin{array}{r} 4\ 513 \\ 3\ 907 \\ \hline \end{array} \quad \begin{array}{r} 4\ 122 \\ 3\ 919 \\ \hline \end{array} \quad \begin{array}{r} 4\ 122 \\ 3\ 929 \\ \hline \end{array} \quad \begin{array}{r} 4\ 122 \\ 3\ 939 \\ \hline \end{array} \end{array}$$

$$\begin{array}{r} 19. \text{ Subtract} \quad \begin{array}{r} 5\ 000 \\ 4\ 900 \\ \hline \end{array} \quad \begin{array}{r} 5\ 000 \\ 4\ 990 \\ \hline \end{array} \quad \begin{array}{r} 5\ 000 \\ 3\ 990 \\ \hline \end{array} \quad \begin{array}{r} 5\ 000 \\ 3\ 999 \\ \hline \end{array} \quad \begin{array}{r} 5\ 000 \\ 3\ 888 \\ \hline \end{array} \end{array}$$

ORAL WORK.

1. Subtract by twos from 24 to 2.
2. Subtract by threes from 36 to 3.
3. Subtract by fours from 48 to 4.
4. Subtract by fives from 60 to 5.
5. Subtract by sixes from 72 to 6.
6. Subtract by sevens from 84 to 7.
7. Subtract by eights from 96 to 8.
8. Subtract by nines from 108 to 9.

Tell the remainders :

9.	$\begin{array}{r} 16 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 36 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 26 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 46 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 66 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 86 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 76 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 96 \\ 7 \\ \hline \end{array}$
10.	$\begin{array}{r} 17 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 37 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 57 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 27 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 47 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 97 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 77 \\ 8 \\ \hline \end{array}$
11.	$\begin{array}{r} 13 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 33 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 63 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 53 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 43 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 73 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 83 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 93 \\ 6 \\ \hline \end{array}$
12.	$\begin{array}{r} 24 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 34 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 54 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 74 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 44 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 84 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 94 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ 9 \\ \hline \end{array}$
13.	$\begin{array}{r} 11 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 21 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 81 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 91 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 31 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 41 \\ 4 \\ \hline \end{array}$
14.	$\begin{array}{r} 27 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 47 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 67 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 57 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 37 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 77 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 97 \\ 9 \\ \hline \end{array}$
15.	$\begin{array}{r} 25 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 35 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 55 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 75 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 95 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 85 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ 8 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ 8 \\ \hline \end{array}$
16.	$\begin{array}{r} 24 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 44 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 34 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 54 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 74 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 94 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 84 \\ 7 \\ \hline \end{array}$

WRITTEN WORK..

1. In 1685 La Salle landed on the coast of Texas. In 1836 the battle of San Jacinto was fought; find the number of years between the two events.

2. From Texarkana to El Paso is 860 miles; from Texarkana to Chicago is 776 miles; how much farther is it from Texarkana to El Paso than from Texarkana to Chicago?

3. The gross earnings of a railroad company in one month amounted to \$1 419 320; the expenses amounted to \$1 296 875; find the net earnings. *Ans.* \$122 445.

4. The population of Nevada in 1880 was 62 266, which was 16 505 more than in 1890; what was Nevada's population in 1890? *Ans.* 45 761.

5. A gentleman sold a plantation for \$23 750, which was \$4 967 more than he paid for it; what did it cost him? *Ans.* \$18 783.

6. The minuend is 671 420; the subtrahend is 483 739; what is the remainder? *Ans.* 187 681.

7. Feb. 25 the shipments of corn from Chicago and Philadelphia, respectively, were 201 697 bushels and 145 816 bushels; find the difference. *Ans.* 55 881 bu.

8. In a storm a cargo of 324 075 pounds was lightened by throwing overboard 69 386 pounds of freight; find the number of pounds remaining. *Ans.* 254 689 lb.

9. The revenue of a city amounts to \$756 320; the sum of its expenses is \$739 278; find the balance. *Ans.* \$17 042.

10. From the difference between 18 321 and 20 110, subtract the difference between 234 969 and 235 132. *Ans.* 1 626.

11. What number added to the difference between one hundred thousand nineteen and eighty-seven thousand nine hundred twenty-eight will make fifteen thousand? *Ans.* 2 909.

REVIEW WORK. — Problems 39 and 46 in Addition.

12.	<u>347 019</u> <u>298 137</u>	<u>462 160</u> <u>398 586</u>	<u>251 721</u> <u>192 817</u>	<u>426 005</u> <u>261 916</u>
13.	<u>216 573</u> <u>162 987</u>	<u>417 062</u> <u>138 156</u>	<u>362 870</u> <u>291 941</u>	<u>376 207</u> <u>179 218</u>
14.	<u>172 637</u> <u>91 783</u>	<u>316 008</u> <u>219 126</u>	<u>733 012</u> <u>198 437</u>	<u>312 690</u> <u>193 792</u>
15.	<u>801 615</u> <u>719 387</u>	<u>261 432</u> <u>172 655</u>	<u>476 321</u> <u>379 265</u>	<u>501 030</u> <u>257 061</u>
16.	<u>471 235</u> <u>273 562</u>	<u>362 610</u> <u>269 725</u>	<u>354 205</u> <u>263 718</u>	<u>426 131</u> <u>135 915</u>
17.	<u>1 061 232</u> <u>925 674</u>	<u>2 917 403</u> <u>1 891 719</u>	<u>3 156 000</u> <u>2 978 012</u>	<u>6 157 270</u> <u>5 872 935</u>
18.	<u>5 672 015</u> <u>1 938 562</u>	<u>7 168 430</u> <u>6 239 555</u>	<u>3 162 740</u> <u>2 557 559</u>	<u>5 468 705</u> <u>1 987 767</u>

19. A remainder is 346, and the minuend is 950; what is the subtrahend? *Ans.* 604.

20. A remainder is 1 991, and the minuend is 3 000; what is the subtrahend? *Ans.* 1 009.

21. A subtrahend is 28 885, and the minuend is 30 000; what is the remainder? *Ans.* 1 115.

22. What number added to 1 775 will make 2 006? *Ans.* 231.

23. Four thousand nine hundred seventy-six is how much less than five thousand eleven? *Ans.* 35.

24. Six thousand twelve is how much more than one thousand seven hundred twenty-nine? *Ans.* 4 283.

25. In subtracting 4 197 from 7 010, a pupil gave 3 923 as the remainder; what was his error? *Ans.* 1 110 too great.

The sign of equality (=) is read *equal* or *equals*.

4 + 6 - 2 = 8 is read, Four *plus* six *minus* two *equals* eight.

REVIEW WORK. — Problems 57 and 58 in *Addition*.

ORAL WORK.

1. Alice had 17 roses; she gave 3 to her teacher, and sent 5 to a sick friend; how many did she then have?

2. A miner made \$11 one week and \$10 the next week; he spent all but \$5; how much did he spend?

3. A fisherman caught one morning 9 trout, and in the evening 7; he sold all but 4; how many did he sell?
 $9 + 7 - 4 = ?$

4. If 13 is subtracted from the sum of 9 and 12, what is the remainder? $9 + 12 - 13 = ?$

5. To the sum of 6 and 7 add the difference between 25 and 31. $6 + 7 + (31 - 25) = ?$

6. Henry read 100 pp. in his book in three days; Monday he read 42 pp., and Tuesday 28 pp.; how many pages did he read the third day?

How many are:

7. $18 + 2 - 3?$

8. $19 + 4 - 4?$

9. $21 + 6 - 8?$

10. $32 + 5 - 9?$

11. $43 + 7 - 6?$

12. $54 + 9 - 8?$

13. $67 + 4 - 9?$

14. $86 + 5 - 7?$

15. $79 + 9 - 4?$

16. $93 + 8 - 4?$

17. $40 + 51 - 9?$

18. $50 + 63 - 8?$

19. $60 + 72 - 7?$

20. $15 + 16 - 10?$

21. $16 + 17 - 11?$

22. $26 + 15 - 12?$

23. $45 + 16 - 13?$

24. $57 + 19 - 20?$

25. $68 + 17 - 18?$

26. $59 + 27 - 19?$

27. $48 + 29 - 18?$

28. $56 + 37 - 17?$

29. $75 + 25 - 26?$

30. $87 + 12 - 13?$

31. $66 + 34 - 33?$

32. $72 + 16 - 41?$

WRITTEN WORK.

1. The salary of a bank clerk is \$1 500 per annum; last year he paid \$240 for rent, \$375 for groceries and fuel, \$259 for clothing, and \$418 for all other expenses, and invested the remainder in real estate; how much did he invest?
Ans. \$208.

2. A man travelled 986 miles in three days; the first day he travelled 437 mi.; the second day 190 mi.; how many the third day?
Ans. 359 mi.

3. A cotton merchant bought two lots of cotton, paying \$3 747 for one lot, and \$6 274 for the other; he sold the whole for \$9 895; did he gain or lose, and how much?
Ans. Lost \$126.

4. A planter owns 1 570 acres of river land, which he rents to four tenants. To the first he rents 265 acres; to the second, 427 acres; to the third, 476 acres; how many acres to the fourth tenant?
Ans. 402 A.

5. A shoe factory made in four weeks 15 340 pr. shoes; the first week 3 412 pairs were made; the second, 3 927 pairs; the third, 3 749 pairs; how many pairs were made the fourth week?
Ans. 4 252 pr.

6. An orchard has five kinds of fruit trees, amounting in all to 1 610 trees; there are 392 peach-trees, 415 apple-trees, 360 pear-trees, 276 plum-trees, and how many cherry-trees?
Ans. 167 cherry-trees.

7. At the beginning of January a dealer had in stock 300 000 ft. of lumber. During the first fifteen days of the month he sold 79 354 ft. of it; during the last sixteen days of the month he sold 123 975 ft. of it; how many feet of it remained unsold?
Ans. 96 671 ft.

8. A farmer made 1 970 bushels of corn on three fields; on one he made 516 bushels, on another 729 bushels; how many bushels on the third?
Ans. 725 bu.

9. From a full cistern holding 4 000 gallons, a family used 2 825 gallons before it rained; the first rain put into the cistern 1 975 gal.; how many gallons of water did the cistern then contain?
Ans. 3 150 gal.

10. The area of Texas is 265 780 square miles; the area of France is 204 096 square miles; the area of England is 58 186 square miles; how much larger is Texas than both France and England? *Ans.* 3 498 sq. mi.

11. The steamer *Future City* towed six barges containing 272 294 bu. corn; the first contained 50 390 bu.; the second, 39 367; the third, 47 219; the fourth, 49 597; the fifth, 42 346; the sixth, how many bushels? *Ans.* 43 375 bu.

12. Receipts of cotton at ten ports of the United States for the week ending March 6, 1892:

Galveston	1 226
Mobile	369
Savannah	2 777
Charleston	470
Wilmington	401
Norfolk	1 250
Boston	455
Philadelphia	302
West Point	690

New Orleans received so many bales that the total for the ten ports amounted to 15 854; how many bales did New Orleans receive? *Ans.* 7 914 *B/C.*

13. Subtract the difference of twenty thousand thirteen and nineteen thousand nine hundred ninety-eight from 31. *Ans.* 16.

14. From the sum of ninety thousand nineteen and ninety-nine thousand seven, subtract their difference.

15. From the sum of one hundred ninety thousand three and two hundred nineteen thousand forty-nine, subtract their difference. *Ans.* 380 006.

REVIEW WORK. — The last problem in Addition.

MULTIPLICATION.

ORAL WORK.

1. How many feet are there in 1 yard?
2. How many feet are in 2 yards? In 3 yards? In 4 yards?
3. Three times a day the mules are fed; how many times are they fed in 3 days? Three times 4 are how many? 3 times 5 = ?
4. A bushel of corn will fill a peck measure 4 times; how many pecks are in 4 bushels? 4 times 4 = ?
5. Add by twos from 2 to 24.
6. What is 5 times 2? 7 times 2? 6 times 2? 8 times 2? 9 times 2? 11 times 2? 10 times 2? 12 times 2?
7. Add by threes from 3 to 36.
8. What is 5 times 3? 7 times 3? 8 times 3? 9 times 3? 6 times 3? 10 times 3? 12 times 3? 11 times 3?
9. Add by fours from 4 to 48.
10. What is 5 times 4? 7 times 4? 6 times 4? 8 times 4? 10 times 4? 9 times 4? 12 times 4? 11 times 4?
11. Add by fives from 5 to 60.
12. What is 5 times 5? 6 times 5? 8 times 5? 7 times 5? 12 times 5? 11 times 5? 9 times 5? 10 times 5?
13. Add by sixes from 6 to 72.
14. What is 5 times 6? 7 times 6? 9 times 6? 8 times 6? 10 times 6? 12 times 6? 11 times 6? 6 times 6?
15. Add by sevens from 7 to 84.
16. What is 5 times 7? 6 times 7? 8 times 7? 7 times 7? 9 times 7? 11 times 7? 10 times 7? 12 times 7?
17. Add by eights from 8 to 96.
18. Add by nines from 9 to 108.

MULTIPLICATION TABLE.

$1 \times 2 = 2$	$1 \times 3 = 3$	$1 \times 4 = 4$	$1 \times 5 = 5$
$2 \times 2 = 4$	$2 \times 3 = 6$	$2 \times 4 = 8$	$2 \times 5 = 10$
$3 \times 2 = 6$	$3 \times 3 = 9$	$3 \times 4 = 12$	$3 \times 5 = 15$
$4 \times 2 = 8$	$4 \times 3 = 12$	$4 \times 4 = 16$	$4 \times 5 = 20$
$5 \times 2 = 10$	$5 \times 3 = 15$	$5 \times 4 = 20$	$5 \times 5 = 25$
$6 \times 2 = 12$	$6 \times 3 = 18$	$6 \times 4 = 24$	$6 \times 5 = 30$
$7 \times 2 = 14$	$7 \times 3 = 21$	$7 \times 4 = 28$	$7 \times 5 = 35$
$8 \times 2 = 16$	$8 \times 3 = 24$	$8 \times 4 = 32$	$8 \times 5 = 40$
$9 \times 2 = 18$	$9 \times 3 = 27$	$9 \times 4 = 36$	$9 \times 5 = 45$
$10 \times 2 = 20$	$10 \times 3 = 30$	$10 \times 4 = 40$	$10 \times 5 = 50$
$11 \times 2 = 22$	$11 \times 3 = 33$	$11 \times 4 = 44$	$11 \times 5 = 55$
$12 \times 2 = 24$	$12 \times 3 = 36$	$12 \times 4 = 48$	$12 \times 5 = 60$
$1 \times 6 = 6$	$1 \times 7 = 7$	$1 \times 8 = 8$	$1 \times 9 = 9$
$2 \times 6 = 12$	$2 \times 7 = 14$	$2 \times 8 = 16$	$2 \times 9 = 18$
$3 \times 6 = 18$	$3 \times 7 = 21$	$3 \times 8 = 24$	$3 \times 9 = 27$
$4 \times 6 = 24$	$4 \times 7 = 28$	$4 \times 8 = 32$	$4 \times 9 = 36$
$5 \times 6 = 30$	$5 \times 7 = 35$	$5 \times 8 = 40$	$5 \times 9 = 45$
$6 \times 6 = 36$	$6 \times 7 = 42$	$6 \times 8 = 48$	$6 \times 9 = 54$
$7 \times 6 = 42$	$7 \times 7 = 49$	$7 \times 8 = 56$	$7 \times 9 = 63$
$8 \times 6 = 48$	$8 \times 7 = 56$	$8 \times 8 = 64$	$8 \times 9 = 72$
$9 \times 6 = 54$	$9 \times 7 = 63$	$9 \times 8 = 72$	$9 \times 9 = 81$
$10 \times 6 = 60$	$10 \times 7 = 70$	$10 \times 8 = 80$	$10 \times 9 = 90$
$11 \times 6 = 66$	$11 \times 7 = 77$	$11 \times 8 = 88$	$11 \times 9 = 99$
$12 \times 6 = 72$	$12 \times 7 = 84$	$12 \times 8 = 96$	$12 \times 9 = 108$
$1 \times 10 = 10$	$1 \times 11 = 11$	$1 \times 12 = 12$	
$2 \times 10 = 20$	$2 \times 11 = 22$	$2 \times 12 = 24$	
$3 \times 10 = 30$	$3 \times 11 = 33$	$3 \times 12 = 36$	
$4 \times 10 = 40$	$4 \times 11 = 44$	$4 \times 12 = 48$	
$5 \times 10 = 50$	$5 \times 11 = 55$	$5 \times 12 = 60$	
$6 \times 10 = 60$	$6 \times 11 = 66$	$6 \times 12 = 72$	
$7 \times 10 = 70$	$7 \times 11 = 77$	$7 \times 12 = 84$	
$8 \times 10 = 80$	$8 \times 11 = 88$	$8 \times 12 = 96$	
$9 \times 10 = 90$	$9 \times 11 = 99$	$9 \times 12 = 108$	
$10 \times 10 = 100$	$10 \times 11 = 110$	$10 \times 12 = 120$	
$11 \times 10 = 110$	$11 \times 11 = 121$	$11 \times 12 = 132$	
$12 \times 10 = 120$	$12 \times 11 = 132$	$12 \times 12 = 144$	

DEFINITIONS.

Multiplication is a short process for finding the sum of as many equal numbers as there are units in another number.

The **Multiplicand** is the number which shows what equal numbers are to be added.

The **Multiplier** is the number which shows how many of the equal numbers are to be added.

The **Product** is the result obtained in multiplication.

The product is of the same nature as the multiplicand.

The multiplier and multiplicand are called **Factors** of the product.

The sign of **Multiplication** (\times) is read *times*, or *multiplied by*.

When the sign precedes the multiplicand, it is read *times*; when it follows the multiplicand, it is read *multiplied by*. In this book the sign is placed before the multiplicand.

WRITTEN WORK.

1. Multiply 695 by 5.

EXPLANATION.

I. Five times 5 units are 25 units, or 5 units and 2 tens. Write the 5 under units.

II. Five times 9 tens are 45 tens, to which add the 2 tens from the product of the units — 47 tens. Write the 7 under tens. $\begin{array}{r} 695 \\ 5 \end{array}$

III. Five times 6 hundreds are 30 hundreds, to which add the 4 hundreds from the product of the tens — 34 hundreds. Write the 4 under hundreds, and the 3 in the thousands' place. $\begin{array}{r} 3475 \end{array}$

2. If a man drives 6 miles per hour for 7 hours, how far does he go?

ANALYSIS.

Distance in 1 hour = 6 mi.
Distance in 7 hours = 7×6 mi.
 7×6 miles = 42 mi.
Distance in 7 hours = 42 mi.

PROCESS.

6 mi.
 $\overline{7}$
42 mi.

3. It is 24 miles around the city of San Antonio; how many miles must a man travel to go round it 5 times?

Ans. 120 mi.

4. How many inches are there in 9 yards? *Ans.* 324 in.
5. A bushel of corn weighs 56 lb.; how many pounds do 8 bushels of corn weigh? *Ans.* 448 lb.
6. What is the cost of 9 tons of cotton-seed meal, at \$21 per ton? *Ans.* \$189.
7. A farmer had 8 hands picking cotton for a week; they averaged 149 lb. per day to the hand; how much did they all pick per day? *Ans.* 1 192 lb.
How much did they pick in the 6 days? *Ans.* 7 152 lb.
8. Find the sum of the products of 9×337 , 6×479 , 7×698 . *Ans.* 10 793.
9. Find the sum of the products of 8×376 , 7×987 , 6×679 . *Ans.* 13 991.
10. Find the sum of the products of $3 \times 9\,876$, $7 \times 7\,698$, $9 \times 6\,897$. *Ans.* 145 587.
11. Find the difference of the products of $9 \times 764\,328$ and $8 \times 974\,685$. *Ans.* 918 528.
12. The multiplier is 7; the multiplicand is 6 784; what is the product? *Ans.* 47 488.
13. Find the sum of the products of $8 \times 35\,798$, $7 \times 65\,796$, $6 \times 989\,706$. *Ans.* 6 685 192.
14. The minuend is $9 \times 5\,876$; the subtrahend is $8 \times 6\,297$; what is the remainder? *Ans.* 2 508.
15. What would be the cost of steerage passage from New Orleans to New York for a family of 9, at \$19 each? *Ans.* \$171.
16. Find the sum of the products of $8 \times 5\,579$, 9×767 , 11×432 . *Ans.* 56 287.
17. A farmer carried to mill 9 bushels of wheat, weighing 60 pounds to the bushel, and 8 bushels of corn, weighing 56 lb. to the bushel; how many pounds of grain in all? *Ans.* 988 lb.

REVIEW WORK.

Problems 12, 13, 14 in written work of Addition and Subtraction.

18. What is the product of 10 and 125? $\begin{array}{r} 125 \\ 10 \end{array}$
19. Multiply 125 by 20. $\begin{array}{r} 125 \\ 20 \end{array}$
20. A farmer bought 30 acres of land, at \$19 per acre; what did all cost? *Ans.* \$570.
21. In 1 mile there are 5 280 ft.; how many feet are there in 40 mi.? *Ans.* 211 200 ft.
22. If there are 29 telegraph poles to the mile, how many telegraph poles in 50 mi.? *Ans.* 1 450 T. P.
23. Seventy mules, at \$125 each, would cost how much money? *Ans.* \$9 750.
24. How many months from 1776 to 1836? $60 \times 12 = ?$
25. The multiplicand is 79; the multiplier is 80; what is the product? *Ans.* 6 320.
26. The multiplier is 90; the multiplicand is 89; what is the product? *Ans.* 8 010.
27. The multiplier is 100;
the multiplicand 76;
what is the product? $\begin{array}{r} 76 \\ 100 \\ \hline 7600 \end{array}$
28. How much would 200 horses, at \$75 per head, cost?
29. A farmer averaged 22 bu. oats per acre on 300 acres; how many bushels in all? *Ans.* 6 600 bu.
30. From Oct. 1492 to Oct. 1892, how many Sundays, counting 52 to the year? *Ans.* 400×52 Sun.
31. A railroad company paid 500 laborers \$9 each for a week's work; how much to all? *Ans.* \$4 500.
32. How many hours are in the first three months of a common year? *Ans.* 2 160 hr.
33. The multiplicand is 455; the multiplier is 500; what is the product?
34. A gentleman bought 100 acres of land at \$6 per acre, and 10 acres at \$27 per acre; what did the 110 acres cost? *Ans.* \$870.
35. A steamer went down the Ohio to Cairo and back; in going down, she made 14 mi. per hr. for 20 hr.; in coming up, she made 7 mi. per hr. for 40 hr.; what was the whole distance? *Ans.* 560 mi.

36. Multiply 1 893 by 365.

EXPLANATION.

I.

Regarding the multiplier as units, tens, and hundreds, the 365 is composed of 5, 60, and 300.

1 893

II.

5

9 465

Multiplying the multiplicand, 1 893, by 5, the first partial product is 9 465.

1 893

III.

60

113 580

Multiplying the multiplicand by 60, the second partial product is 113 580.

1 893

IV.

300

567 900

Multiplying the multiplicand by 300, the third partial product is 567 900.

9 465

V.

113 580

567 900

690 945

Adding the three partial products, the entire product is 690 945.

IN PRACTICE.

I. Multiply by the 5 units of the multiplier.

II. Regard as units the 6 tens of the multiplier. Multiply by 6, pushing the product one place to the left, by placing or imagining a nought under the units of the first partial product.

(Pushing the product one place to the left multiplies it by 10 ; it is now the product of the multiplicand and the 6 tens of the multiplier.)

1 893

365

9 465

III. Regard as units the 3 hundreds of the multiplier. Multiply by 3, pushing the product two places to the left, by placing or imagining noughts under the units and tens of the other partial products.

113 580

567 900

680 945

(Pushing the product two places to the left multiplies it by 100 ; it is now the product of the multiplicand and the 3 hundreds of the multiplier.)

IV. Add the partial products for the total product.

37. In 1 barrel of flour there are 196 lb.; how many pounds are in 23 bbl. of flour? *Ans.* 4 508 lb.

38. In 1 mile there are 1 760 yards; how many yards are in 24 miles? *Ans.* 42 240 yd.

39. In 1 bushel there are 32 quarts; how many quarts are in 26 bushels? *Ans.* 832 qt.

40. There are 60 minutes in 1 hour; how many minutes are in 24 hours? *Ans.* 1 440 min.

41. A farmer made an average of 25 bu. corn to the acre on a field of 46 acres; how many bushels did he make on the field? *Ans.* 1 150 bu.

42. In a square mile there are 640 acres; how many acres are in 27 square miles? *Ans.* 17 280 A.

43. A railroad company purchased 28 acres of land at \$325 per acre; how much was paid for the whole? *Ans.* \$9 100.

44. The multiplicand is 6 812;
the multiplier is 203;
what is the product?

Since there is no ten in the multiplier, there are only two partial products.

$$\begin{array}{r} 6\ 812 \\ \times 203 \\ \hline \end{array}$$

45. A cotton merchant bought 104 B/C averaging 469 lb. What was the entire weight? *Ans.* 48 776 lb.

46. For the founding of Jamestown, the London Company sent out 105 men, at a cost of 35 pounds of English money to the man; what was the whole cost? *Ans.* £ 3 675.

47. A school district, reporting 209 children of school age, receives \$5 for each from the Public School Fund; how much does the district receive for all? *Ans.* \$1 045.

48. Columbus made an average westward progress of 43 mi. per day for 69 days; how far west did he sail? *Ans.* 2 967 mi.

49. How many yards are in 39 bolts of sheeting, averaging 42 yards to the bolt? *Ans.* 1 638 yd.

50. What is the weight of 126 bu. oats, at 32 lb. to the bushel? *Ans.* 4 032 lb.

51. A farmer bought 1 728 acres of land at \$15 per acre; what was the whole cost?

EXPLANATION.

When the multiplier is a much larger number than the multiplicand, the numerical product is more quickly found by reversing the factors. The product, however, is of the same nature as the *true* multiplicand.

PROCESS.

$$\begin{array}{r} 1\ 728 \\ \times 15 \\ \hline \times \times \times \\ \times \times \times \\ \hline \$ \times \times \times \times \end{array}$$

In solving the problems below, write the word *multiplied* opposite each true multiplicand.

52. What would be the cost of 447 sheep @ \$7 a head?
Ans. \$3 129.

53. A farmer made an average profit of \$4 per acre on 76 acres in cotton, and \$5 per acre on 69 acres in oats; what were his profits on both?
Ans. \$649.

54. To fence a field the owner finds that 3 598 panels, each of 12 rails, will be required; how many rails will it take for the field?
Ans. 43 176 rails.

55. For a reunion of old soldiers a ticket agent sold 1 797 round-trip tickets at \$3 each; find the cost of all the tickets.
Ans. \$5 391.

56. A field of 162 acres of corn yielded 34 bushels to the acre; how many bushels in all?
Ans. 5 508 bu.

How many pounds in all, counting 56 lb. to the bushel?
Ans. 308 448 lb.

57. The total yield of sweet potatoes in one county was 15 798 bu.; how many pounds, at 55 lb. to the bushel?
Ans. 868 890 lb.

58. If there are 2 640 cross-ties to the mile, how many are in a railroad 79 miles long?
Ans. 208 560 cross-ties.

59. In a square mile there are 640 acres; how many acres are there in a county containing 879 sq. mi.?
Ans. 562 560 A.

Find the products:

60.	$61 \times 79.$	94.	$5 \times 5 \times 5.$
61.	$159 \times 108.$	95.	$6 \times 6 \times 6.$
62.	$197 \times 207.$	96.	$6 \times 6 \times 7.$
63.	$176 \times 193.$	97.	$7 \times 7 \times 7.$
64.	$99 \times 198.$	98.	$7 \times 7 \times 8.$
65.	$186 \times 79.$	99.	$8 \times 8 \times 8.$
66.	$467 \times 96.$	100.	$8 \times 8 \times 9.$
67.	$298 \times 69.$	101.	$9 \times 9 \times 9.$
68.	$289 \times 96.$	102.	$9 \times 9 \times 11.$
69.	$397 \times 87.$	103.	$11 \times 11 \times 11.$
70.	$479 \times 78.$	104.	$11 \times 11 \times 12.$
71.	$468 \times 97.$	105.	$12 \times 12 \times 12.$
72.	$479 \times 79.$	106.	$12 \times 12 \times 13.$
73.	$579 \times 97.$	107.	$13 \times 13 \times 13.$
74.	$569 \times 79.$	108.	$13 \times 13 \times 14.$
75.	$659 \times 79.$	109.	$14 \times 14 \times 14.$
76.	$769 \times 79.$	110.	$14 \times 14 \times 15.$
77.	$679 \times 97.$	111.	$15 \times 15 \times 15.$
78.	$769 \times 97.$	112.	$15 \times 15 \times 16.$
79.	$797 \times 67.$	113.	$16 \times 16 \times 16.$
80.	$779 \times 76.$	114.	$16 \times 16 \times 17.$
81.	$779 \times 97.$	115.	$17 \times 17 \times 17.$
82.	$876 \times 79.$	116.	$17 \times 17 \times 18.$
83.	$867 \times 76.$	117.	$18 \times 18 \times 18.$
84.	$979 \times 67.$	118.	$18 \times 18 \times 19.$
85.	$997 \times 79.$	119.	$18 \times 19 \times 19.$
86.	$979 \times 76.$	120.	$21 \times 21 \times 21.$
87.	$989 \times 67.$	121.	$22 \times 22 \times 23.$
88.	$998 \times 76.$	122.	$24 \times 24 \times 24.$
89.	$1998 \times 769.$	123.	$25 \times 25 \times 25.$
90.	$2989 \times 679.$	124.	$18 \times 17 \times 36.$
91.	$9789 \times 769.$	125.	$36 \times 38 \times 47.$
92.	$8789 \times 679.$	126.	$56 \times 63 \times 79.$
93.	$9879 \times 796.$	127.	$84 \times 85 \times 89.$

(Columns on second half of page 19 show the answers.)

WRITTEN WORK.

1. A carpenter spends \$2 every day; each day that he works he earns \$3; he works 25 days in July and 24 days in August; how much does he save in the two months?

Ans. \$23.

2. Out of a fifty-dollar note a traveller paid in 3 days \$18 for railway fares, and \$5 per day for all other expenses; how much of his \$50 remained?

Ans. \$17.

3. From a cistern containing 1 763 gallons of water, 47 gallons a day are used for watering the stock, and 59 gallons for all other purposes; how many gallons should be in the cistern at the end of 12 days?

Ans. 491 gal.

4. A farmer's corn crop is 37 bu. to the acre on 43 acres; he needs for the year 72 bu. for meal, and 3 bushels per day for feeding stock; how many bushels can he afford to sell?

Ans. 424 bu.

5. A ship sailed 131 miles per day for 7 days, 129 miles per day for 6 days, and in 5 days more completed her voyage of 2 297 miles; how far did she sail in the last 5 days?

Ans. 606 mi.

6. From three fields a farmer harvested 1 813 bushels of grain; he made 27 bu. corn per acre on 19 acres, 19 bu. wheat per acre on 41 acres, and oats on the other field; how many bushels of oats did he make?

Ans. 521 bu. oats.

7. In nine loads a wagon hauls 22 400 pounds; the first 7 loads average 2 629 lb.; the eighth load weighs 2 000 lb.; what is the weight of the last load?

Ans. 1 997 lb.

8. To plant an orchard 1 072 trees are needed. There are to be 24 rows of apple-trees, 16 trees to the row; 36 rows of peach-trees, 16 to the row; and all the other trees are to be pears; how many pear-trees are needed?

Ans. 112 pear-trees.

9. A vessel sails from New York to Liverpool laden with 2 590 *B/C*, averaging 475 lb., and grain (in bulk) weighing 790 000 lb. On her return she brings a cargo of assorted merchandise weighing 1 750 000 lb.; find the *difference* in weight between the exports and imports.

DIVISION.

SUBTRACTIONAL DIVISION.

ORAL WORK.

1. How many yards are there in 6 feet?
2. What must 4 be multiplied by to make 8?
3. Subtract by twos from 24 to 0.
4. The product is 10; the multiplicand is 5; what is the multiplier?
5. John paid 15 cents for oranges at 5 cents apiece; how many oranges did he buy?
6. Subtract by threes from 36 to 0.
7. The product is 36; the multiplicand is 3; what is the multiplier?
8. George paid 20 cents for pencils at 4 cents apiece; how many pencils did he buy?
9. Subtract by fours from 48 to 0.
10. The product is 48; the multiplicand is 4; what is the multiplier?
11. How many nickels are in 50 cents?
12. Subtract by fives from 60 to 0.
13. The multiplicand is 7; the product is 42; what is the multiplier?
14. Subtract by sixes from 72 to 0.
15. How many eights are in 56?
16. Subtract by sevens from 84 to 0.
17. If a man works 8 hours per day, in how many days will he work 96 hours?

WRITTEN WORK.

1. The multiplicand is 4;
the product is 444;
what is the multiplier?
$$\begin{array}{r} 4 \overline{)444} \\ 111 \end{array}$$
2. How many times is 5 contained in 555?
Ans. 111 times.
3. If a merchant sells sugar at 6 cents per pound, how many pounds does he sell for 66 cents?
Ans. 11 lb.
4. Some boys shared equally 48 apples; each boy received 4 apples; how many boys were there?
Ans. 12 boys.
5. A merchant gained \$35 from the sale of cloaks, his profit on each cloak being \$5; how many cloaks did he sell?
Ans. 7 cloaks.
6. How many times does \$363 contain \$3?
Ans. 121 times.
7. How many times can \$4 be subtracted from \$484?
Ans. 121 times.
$$\begin{array}{r} \$4 \overline{) \$484} \end{array}$$
8. The multiplicand is 4; the product is 4884; what is the multiplier?
Ans. 1221.
9. The multiplicand is 6;
the product is 612;
what is the multiplier?
$$\begin{array}{r} 6 \overline{)612} \\ 102 \end{array}$$

EXPLANATION.

I. Since 6 is contained in the 6 hundreds 1 hundred times, write 1 under the hundreds.

II. Since 6 is not contained ten times in 1 ten, write 0 under the 1 ten.

III. Since 6 is contained 2 times in the 12 units, write 2 under the units.

10. How many times does 816 contain 8?
11. How many weeks are there in 721 days?
12. Each receiving \$9, how many laborers were paid \$936 for a week's work?
Ans. 104 laborers.
13. The multiplicand is 6; the product is 12006; what is the multiplier?
Ans. 2001.

REVIEW WORK. — Problem 56 in Addition.

PARTITIVE DIVISION.**ORAL WORK.**

1. If 4 boys share equally 48 apples, how many apples will each boy have?

2. What number can be subtracted just 4 times from 48? What is $\frac{1}{4}$ of 48?

3. The multiplier is 6; the product is 72; what is the multiplicand?

4. If 72 acres of land be divided into 3 equal fields, how many acres will be in each?

5. In 9 miles there are 72 furlongs; how many furlongs are in 1 mile?

6. In 5 bushels there are 40 half-pecks; how many half-pecks are in 1 bushel?

7. The multiplier is 9; the product is 108; what is the multiplicand?

8. If 8 men share equally 56 lb. beef, how many pounds of beef will each man have?

9. What number can be subtracted from 45 just 5 times?

10. If 8 cart-loads of sand weigh 4800 lb., what is the average weight to the load?

11. If 12 pencils cost 60 cents, what is the cost of 1 such pencil?

12. If a man travels 88 miles in 11 hours, what is his average speed per hour?

13. The multiplier is 12; the product is 132; what is the multiplicand?

14. If 12 cars have 96 wheels, how many wheels does 1 car have?

15. What number can be subtracted from 100 just 4 times?

16. Frank rode on his bicycle 45 miles in 5 hours; what was his average rate of speed per hour?

WRITTEN WORK.

1. If 6 bales of cotton weigh 3 006 lb., what is the average weight per bale? *Ans.* 501 lb.

2. If 7 bu. corn-meal weigh 336 lb., what is the weight of 1 bushel? *Ans.* 48 lb.

$\frac{1}{4}$ of 33 tens is 4 tens, and 5 tens remain; the 5 tens are 50 $\overline{7)336}$ units, to be added to the 6 units; $\frac{1}{4}$ of 56 units is 8 units. 48

3. If 9 tons of cotton-seed meal can be bought for \$198, what is the price per ton? *Ans.* \$22.

4. If 8 bu. oats weigh 256 lb., what is the weight of 1 bushel? *Ans.* 32 lb.

5. The multiplier is 6; the product is 2 202; what is the multiplicand? *Ans.* 367.

6. A ship sails 1 260 mi. in 7 days; what is her average speed per day? *Ans.* 180 mi.

7. A wagon hauled 7 776 bricks in 8 loads; how many bricks to the average load? *Ans.* 972 bricks.

8. If in 9 miles there are 261 telegraph poles, how many telegraph poles are there to the mile? *Ans.* 29 t. p.

9. The hammer of a clock makes 1 092 strokes in a week; how many strokes does it make each day? *Ans.* 156 strokes.

10. The multiplier is 5; the product is 71 905; what is the multiplicand? *Ans.* 14 381.

11. An express train ran 987 mi. in the same time that a freight train ran one-fourth of the same distance; how many miles did the freight train run during the time? *Ans.* $246\frac{1}{4}$ mi.

12. The pay of the General of the army is \$13 500 per year; the pay of an infantry First Lieutenant is one-ninth as much as the General's pay; how much does the Lieutenant receive per year? *Ans.* \$1 500.

13. For grinding corn a miller charges one-seventh of the corn for toll; how many bushels will be his toll from 1 932 bushels of corn? *Ans.* 276 bu.

DEFINITIONS.

Division is a process for finding the number of times a given number contains another given number,

Or for finding the number that is contained in a given number a given number of times.

I. In each of the problems on pages 41 and 42, the division finds the number of times one number contains another.

II. In each of the problems on pages 43 and 44, the division finds the number that another number contains, thus finding one of the equal parts of a number.

The **Dividend** is the number to be divided.

The **Divisor** is the number to divide by.

The **Quotient** is the result in **Division**.

I. In each of the problems on pages 41 and 42, the **Quotient** is a number without a name : it is simply a number of *times*.

II. In each of the problems on pages 43 and 44, the **Quotient** is of the same nature as the **Dividend**.

The **Remainder** is the part of the **Dividend** left undivided.

The **Divisor** and **Quotient** are **Factors** of the **Dividend**.

The **Dividend** corresponds to the **Product** in **Multiplication**.

I. In each of the problems on pages 41 and 42, the **Divisor** corresponds to the multiplicand, and the **Quotient** sought corresponds to the multiplier.

II. In each of the problems on pages 43 and 44, the **Divisor** corresponds to the multiplier, and the **Quotient** sought corresponds to the multiplicand.

The sign of **Division** (\div) is read *divided by*.

It shows that the number before it is to be divided by the number after it. $8 \div 4$ is read *8 divided by 4*.

(The multiplication table may readily be used as a division table. Each product may be regarded as a dividend, and either of its factors as a divisor ; the other factor is the quotient.

The two classes or kinds of division are intermixed in the problems that follow this page.

The teacher should frequently question the pupil with the view of developing an insight into the distinction.)

WRITTEN WORK.

1. A man rode 72 miles, at the rate of 9 miles per hour; *how many hours?*

ANALYSIS.

Time for riding 9 miles = 1 hour.

Time for riding 72 miles = as many times 1 hour as 72 miles contains 9 miles.

72 miles contains 9 miles 8 times.

8 times 1 hour = 8 hours.

Hence, time for riding 72 miles = 8 hours.

2. A man rode 72 miles in 8 hours, making the same distance every hour; in 1 hour he rode *how many miles?*

ANALYSIS.

Distance made in 8 hr. = 72 mi.

Distance made in 1 hr. = $\frac{1}{8}$ of 72 mi.

$\frac{1}{8}$ of 72 mi. = 9 mi.

3. The yearly salaries of 6 travelling salesmen amount to \$9 900; what is the average salary? *Ans.* \$1 650.

4. The yearly expenses of 7 travelling salesmen amount to \$9 800; what is the average? *Ans.* \$1 400.

5. A butcher paid \$54 for 9 head of sheep; find the average cost per head?

6. A farmer sold hogs at \$9 per head, and received \$63 for them; how many hogs did he sell?

7. On 8 acres a farmer raised 977 bushels of sweet potatoes; how many bushels did he average to the acre?

Ans. $122\frac{1}{8}$ bu.

8. A multiplicand and another factor make the product 990. The other factor is 9; what is the multiplicand?

9. A multiplier and another factor make the product 8 056. The other factor is 8; what is the multiplier?

10. The dividend is 700 acres of land, and the divisor is 7; *what is the quotient?* *Ans.* 100 acres.

11. The dividend is \$8829, and the quotient is 9; what is the divisor? *Ans.* \$981.

12. Lewis hoed 1440 hills of corn in 6 hours; how many did he average per hour? *Ans.* 240 hills.

Divide 88326 by 42.

EXPLANATION.

I. See how many thousand times 88000 contains 42, — 2000 times. Write 2000 as the first partial quotient. Multiply the divisor by the partial quotient, — $2000 \times 42 = 84000$, — which subtract from the dividend for a smaller dividend.

42	88326	2000
	84000	

II. See how many hundred times the remainder of the dividend (4326) contains the divisor 42, — 100 times. Write 100 as the second partial quotient. Multiply the divisor by the second partial quotient, — $100 \times 42 = 4200$, — which subtract from the dividend.

42	4326	100
	4200	

42	126	3
	126	

	000	2103
--	-----	------

III. See how many times the remainder of the dividend (126) contains the divisor 42, — 3 times. Write 3 as the last partial quotient. Multiply the divisor by the last partial quotient, — $3 \times 42 = 126$, — which subtract from the dividend. There is no remainder.

IV. Add the partial quotients. The whole quotient is 2103.

IN PRACTICE.

I. See how many times 88 contains 42. Write the 2 in the thousands' place in the quotient. Twice 42 is 84. Place 84 under 88, and subtract. Bring down the next figure of the dividend.

	2103
42	88326

II. See how many times 43 contains 42. Write 1 in the hundreds' place in the quotient. Multiply 42 by 1. Place the product under 43, and subtract. Bring down the next figure of the dividend.

84
43
42

III. See how many times 12 contains the divisor. Write 0 in the tens' place in the quotient. Bring down the next figure of the dividend.

126
126
0

IV. See how many times 126 contains the divisor. Write 3 in the units' place in the quotient; multiply; subtract, and there is no remainder.

WRITTEN WORK.

1. At \$13 per month, how long must a private soldier serve to receive \$273? *Ans.* 21 mo.

2. If 23 acres produce 506 bushels of wheat, what is the average yield per acre? *Ans.* 22 bu.

3. At 32 lb. to the bushel, how many bushels of oats will weigh 6 432 lb.? *Ans.* 201 bu.

4. How many days are 4 848 hours? *Ans.* 202 da.

5. A farmer received \$4 059 for 123 *B/C*; what was the average price paid per bale? *Ans.* \$33.

6. Mr. Rose's vineyard has 16 368 vines in 132 rows; how many vines to the average row? *Ans.* 124 vines.

7. A farm of 143 acres was sold for \$3 146; what was the price paid per acre? *Ans.* \$22.

8. At 55 lb. to the bushel, how many bushels of sweet potatoes will weigh 605 lb.? *Ans.* 11 bu.

9. By using all of a 25-lb. bag, a man had ounce-loads of shot for 400 shells; how many ounces make a pound?

10. At the average cost of a shilling each, an Englishman gave 2 500 books to a public library; the total cost was £125; how many shillings make a pound, English money?

11. In 34 days Newton received 1 462 *B/C*; how many bales were the average daily receipts?

12. A miller ground 5 412 bushels corn at an average of 44 bu. per day; how many days?

13. On each of 232 cards there is a gross of buttons; the total number of buttons is 33 408; how many make a gross?

14. A carrier pigeon flew 952 miles in 14 hours; how many miles per hour?

15. In a cistern there are 6 480 gallons of water; how long will the water last if 45 gal. be used per day?

Ans. 144 da.

REVIEW WORK.— Problems 57, 58, 59 in **Multiplication.**

Find the quotients:

- | | | | |
|-----|---------------------|-----|----------------------------|
| 16. | $20\,592 \div 144.$ | 50. | $70\,587 \div 279.$ |
| 17. | $18\,792 \div 162.$ | 51. | $70\,866 \div 254.$ |
| 18. | $16\,170 \div 154.$ | 52. | $71\,446 \div 278.$ |
| 19. | $23\,023 \div 161.$ | 53. | $72\,217 \div 257.$ |
| 20. | $5\,830 \div 265.$ | 54. | $74\,226 \div 267.$ |
| 21. | $5\,600 \div 175.$ | 55. | $76\,176 \div 276.$ |
| 22. | $6\,325 \div 23.$ | 56. | $81\,189 \div 279.$ |
| 23. | $29\,680 \div 112.$ | 57. | $85\,813 \div 287.$ |
| 24. | $30\,132 \div 124.$ | 58. | $89\,999 \div 301.$ |
| 25. | $30\,500 \div 244.$ | 59. | $90\,298 \div 299.$ |
| 26. | $30\,870 \div 126.$ | 60. | $93\,274 \div 313.$ |
| 27. | $31\,122 \div 247.$ | 61. | $101\,277 \div 363.$ |
| 28. | $36\,424 \div 157.$ | 62. | $101\,556 \div 279.$ |
| 29. | $36\,738 \div 234.$ | 63. | $104\,907 \div 289.$ |
| 30. | $36\,972 \div 158.$ | 64. | $108\,537 \div 363.$ |
| 31. | $37\,206 \div 159.$ | 65. | $104\,152 \div 376.$ |
| 32. | $37\,835 \div 161.$ | 66. | $110\,763 \div 397.$ |
| 33. | $37\,996 \div 236.$ | 67. | $133\,408 \div 379.$ |
| 34. | $38\,468 \div 163.$ | 68. | $154\,822 \div 398.$ |
| 35. | $39\,105 \div 237.$ | 69. | $268\,992 \div 467.$ |
| 36. | $39\,984 \div 168.$ | 70. | $315\,692 \div 676.$ |
| 37. | $40\,391 \div 239.$ | 71. | $1\,002\,363 \div 597.$ |
| 38. | $40\,869 \div 171.$ | 72. | $1\,002\,960 \div 1\,680.$ |
| 39. | $41\,452 \div 241.$ | 73. | $1\,599\,363 \div 597.$ |
| 40. | $41\,866 \div 173.$ | 74. | $1\,711\,242 \div 639.$ |
| 41. | $44\,652 \div 183.$ | 75. | $2\,146\,833 \div 767.$ |
| 42. | $44\,835 \div 245.$ | 76. | $2\,202\,813 \div 2\,799.$ |
| 43. | $62\,484 \div 254.$ | 77. | $2\,292\,969 \div 797.$ |
| 44. | $62\,230 \div 245.$ | 78. | $2\,580\,669 \div 2\,877.$ |
| 45. | $67\,678 \div 274.$ | 79. | $2\,666\,979 \div 927.$ |
| 46. | $67\,952 \div 248.$ | 80. | $2\,973\,024 \div 2\,976.$ |
| 47. | $68\,724 \div 276.$ | 81. | $2\,997\,999 \div 999.$ |
| 48. | $69\,527 \div 251.$ | 82. | $3\,136\,809 \div 897.$ |
| 49. | $69\,804 \div 277.$ | 83. | $3\,312\,951 \div 3\,769.$ |

(Columns on first half of page 19 show the answers.)

REVIEW. — WRITTEN WORK.

1. The corn crop of Texas in 1879 was 29 065 172 bushels; in 1889 the corn crop of Texas was 67 629 851 bushels; find the difference between the two crops.

Ans. 38 564 679 bu.

2. A field of wheat yielded 50 bushels to every 3 acres; the total yield was 450 bushels; how many acres were in the wheat-field?

Ans. 27 A.

3. A number is composed of two factors, one of which is twice as large as the other; the larger factor is 16; what is the number?

4. From A. to D. is 364 miles. Express train No. 3, as per schedule time, runs 26 miles per hour; before starting for D. it is delayed 2 hours at A.; what rate of speed must it make to reach D. on time?

Ans. $30\frac{4}{5}$ mi. per hr.

5. How many pounds of seed-cotton will make 6 bales, weighing 500 lb. each, if it require 1 350 lb. seed-cotton for a bale weighing 450 lb.?

Ans. 9 000 lb.

6. A farmer needs 12 bu. meal; how many pounds of corn must he send to mill, corn weighing 56 lb. to the bushel, and the miller giving meal for corn, bushel for bushel?

Ans. 672 lb. corn.

7. If a family use 18 eggs twice a day, how many dozen would be used in the month of May?

Ans. 93 doz.

8. A farm containing 720 acres is divided into 3 unequal parts; there is a pasture containing 60 acres, a tract of timber land as wide as the pasture but 4 times as long, and the remainder is in cultivation; how many acres are in cultivation?

Ans. 420 A.

9. Multiplicand, 3 706; multiplier, the difference between 9×7 and $42 \div 14$; product = ?

Ans. 222 360.

10. How many miles apart are two boats which passed each other 3 hours ago and have since made a constant speed, the one going down 12 miles per hour, and the up-bound boat going 9 miles per hour?

Ans. 63 miles.

11. Two farms sold for \$11 652. The smaller one contained 239 acres, and brought \$16 per acre; the other brought \$19 per acre; how many acres in the large farm?
Ans. 412 A.

12. The cargo of the steamship *El Mar* would load 254 freight cars with 23 000 lb. each; how many wagon-loads of 2 000 lb. each are in the cargo?
Ans. 2921 w. l.

13. At an election for mayor, the successful candidate received a majority of 119 votes; the number of votes cast for the defeated candidate was 1024; how many votes were cast for both?
Ans. 2167 votes.

14. In the presidential election of 1884 there were 4845 255 votes cast for the successful candidate. How many votes were cast for another candidate who received 26 584 fewer votes than the successful candidate?
Ans. 4 818 671.

15. A trader bought a plantation for \$14 per acre, and sold it for \$15 824, gaining \$2 per acre; find the amount he paid for the plantation.
Ans. \$13 846.

16. A year ago a company had only 129 miles of railway; during the year it constructed such a number of miles of road that it now has 3 times as many as it had last year; how many miles of road did it build during the year?
Ans. 258 miles.

17. What number added to itself will equal the quotient of $271\,584 \div 276$?
Ans. 492.

18. In 1891 B's corn crop was 32 bu. to the acre. In 1892 the yield per acre was the same, but the acreage was twice as great; the total yield in 1892 was 2 560 bu.; how many acres did B have in corn in 1891?
Ans. 40 acres.

19. How many sacks, each to contain 112 lb., would hold the product of a field of 80 acres of corn yielding 32 bu. to the acre?
Ans. 1 280 sacks.

20. A field has a fence 12 rails high ; in each end there are 75 panels, and in each side, 195 panels ; how many rails in the fence ?
Ans. 6 480 rails.

21. A train runs from A to B, 360 miles, in 17 hours, making 30 stops, averaging 4 minutes each ; find the train's average rate of speed while running.

Ans. 24 mi. per hr.

22. An apple orchard has 28 rows of trees, 24 trees to the row ; the yield averages 3 bushels to the tree ; a bushel weighs 56 lb. ; how many pounds will the whole crop weigh ?
Ans. 112 896 lb.

23. In a square mile there are 640 acres. In one state 52 counties of equal size contain 29 952 000 acres ; how many acres in each county ?
Ans. 576 000 acres.

How many square miles in each county ?

Ans. 900 sq. mi.

24. A reporter wrote in shorthand a speech of 6 480 words in 54 minutes ; how many words to the minute ?

Ans. 120 words.

The speech was then transcribed with a typewriter, at the rate of 36 words to the minute ; how many minutes ?

Ans. 180 min.

25. The average output of a flouring mill is 127 bbl. per day, at 196 lb. to the barrel, and 313 workdays to the year, how many pounds of flour per year ?

Ans. 7 791 196 lb.

26. In 1885 the entire corn crop of the United States amounted to 1 936 000 000 bushels ; how many fields of 25 acres each, producing 25 bushels to the acre, would be required to produce such a quantity of corn ?

Ans. 3 097 600 fields.

27. By the first census of the United States (1790) the population was found to be 3 929 214. The census of 1890 shows the population to be 62 622 250 ; what has been the increase in 100 years ?
Ans. 58 693 036.

CANCELLATION.



ORAL WORK.

1. What are the factors in multiplication? In division?
2. (1) The multiplier is 10; the multiplicand is 20; what is the product? $10 \times 20 = ?$
(2) The multiplier is 10; the multiplicand is 10; what is the product? $10 \times 10 = ?$
(3) The first multiplicand is how many times the second multiplicand? $20 \div 10 = ?$
(4) The first product is how many times the second product? $200 \div 100 = ?$
3. (1) The dividend is 200; the divisor is 10; what is the quotient? $200 \div 10 = ?$
(2) The dividend is 20; the divisor is 10; what is the quotient? $20 \div 10 = ?$
(3) The first dividend is how many times the second dividend? $200 \div 20 = ?$
(4) The first quotient is how many times the second quotient? $20 \div 2 = ?$
4. (1) What figures are used in writing 20?
(2) What figure is used in writing 2?
(3) If 2 is multiplied by 10, what figures are used in writing the product?
(4) If 20 is divided by 10, what figure is used in writing the quotient?
5. (1) Write 2. (2) Place a nought to the right of it.
(3) By what number has the 2 been multiplied?
(4) Write 20. (5) Erase or cancel the nought (0).
(6) By what number has the 20 been divided?

WRITTEN WORK.

1. Divide 240 by 20.

$$2\cancel{0})24\cancel{0} = 24 \div \dot{2} = 12.$$

2. Divide 240 by 20, cancelling the factor 10.

$$\frac{2\cancel{4}\cancel{0}}{2\cancel{0}} = \frac{24}{2} = 12.$$

3. Divide 3 640 by 40.

Ans. 91.

4. Divide 7 280 by 80.

Ans. 91.

5. Divide 14 560 by 160.

Ans. —.

6. Divide 2 400 by 200, cancelling the factor 100.

$$\frac{2\cancel{4}\cancel{0}\cancel{0}}{2\cancel{0}\cancel{0}} = \frac{24}{2} = 12.$$

7. Divide 291 200 by 3 200.

8. Divide
- $300 \times 2\,400$
- by
- 300×20
- .

Ans. 120.

9. Work problem No. 8 by cancellation.

$$\frac{3\cancel{0}\cancel{0} \times 2\,400}{3\cancel{0}\cancel{0} \times 20} = \frac{2\,40\cancel{0}}{2\cancel{0}} = \frac{240}{2} = 120.$$

10. Divide by cancellation
- $200 \times 3\,600$
- by
- 200×200
- .

11. By cancellation divide
- $300 \times 2\,700$
- by
- 300×300
- .

12. By cancellation divide
- $300 \times 3\,200$
- by
- 300×400
- .

13. By cancellation divide
- $400 \times 3\,200$
- by
- 400×800
- .

14. By cancellation divide
- 4×500
- by
- 8×50
- .

$$\frac{\overset{1}{\cancel{4}} \times 500}{\underset{2}{\cancel{8}} \times 50} = \frac{1 \times 500}{2 \times 50} = \frac{5\cancel{0}\cancel{0}}{1\cancel{0}\cancel{0}} = 5.$$

15. By cancellation divide
- 3×500
- by 6 times 50.

16. By cancellation divide
- 4×600
- by 8 times 60.

17. By cancellation divide
- 3×900
- by 9 times 300.

Ans. 1.**REVIEW WORK. — 51 and 52 in Addition.**

ORAL WORK.

1. What is the quotient in the following :
 - (1) Dividend 4; divisor 2?
 - (2) Dividend 2; divisor 1?
2. (1) Dividend $\frac{8}{4}$; what is the quotient?
Divisor $\frac{4}{4}$;
- (2) Dividend $\frac{4}{2}$; what is the quotient?
Divisor $\frac{2}{2}$;
- (3) Dividend $\frac{2}{1}$; what is the quotient?
Divisor $\frac{1}{1}$;
3. (1) Dividend $\frac{4 \times 2}{2 \times 2}$; what is the quotient?
Divisor $\frac{2 \times 2}{2 \times 2}$;
- (2) Dividend $\frac{4}{2}$; what is the quotient?
Divisor $\frac{2}{2}$;
4. How many factors in $3 \times 3 \times 2$?
5. Dividend $\frac{3 \times 3 \times 4}{3 \times 3 \times 2}$; what is the quotient?
Divisor $\frac{3 \times 3 \times 2}{3 \times 3 \times 2}$;

Tell the quotients:

- | | | |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 6. $\frac{2 \times 2 \times 6}{2 \times 2 \times 3} = ?$ | $\frac{2 \times 3 \times 4}{2 \times 3 \times 2} = ?$ | $\frac{2 \times 4 \times 8}{2 \times 4 \times 2} = ?$ |
| 7. $\frac{4 \times 2 \times 6}{2 \times 2 \times 6} = ?$ | $\frac{4 \times 4 \times 3}{4 \times 2 \times 3} = ?$ | $\frac{5 \times 6 \times 9}{5 \times 2 \times 9} = ?$ |
| 8. $\frac{4 \times 4}{2 \times 2} = ?$ | $\frac{3 \times 4 \times 4}{3 \times 2 \times 2} = ?$ | $\frac{3 \times 4 \times 4 \times 4}{3 \times 4 \times 2 \times 2} = ?$ |
| 9. $\frac{4 \times 6}{2 \times 3} = ?$ | $\frac{4 \times 6 \times 6}{2 \times 3 \times 6} = ?$ | $\frac{4 \times 6 \times 6 \times 6}{2 \times 3 \times 6 \times 6} = ?$ |
| 10. $\frac{\cancel{5} \times \cancel{10} \times \cancel{10}}{\cancel{5} \times \cancel{10} \times 2} = ?$ | $\frac{\cancel{3} \times 6 \times \cancel{7}}{\cancel{7} \times \cancel{3} \times 2} = ?$ | $\frac{\cancel{2} \times 12 \times \cancel{9}}{\cancel{9} \times 3 \times \cancel{2}} = ?$ |
| 11. $\frac{\cancel{9} \times 12 \times \cancel{18}}{\cancel{18} \times \cancel{9} \times 3} = ?$ | $\frac{27 \times \cancel{5} \times \cancel{16}}{\cancel{16} \times 9 \times \cancel{5}} = ?$ | $\frac{\cancel{32} \times 42 \times \cancel{52}}{\cancel{52} \times \cancel{32} \times 7} = ?$ |
| 12. $\frac{\cancel{8} \times 14}{\cancel{4} \times \cancel{2} \times 7} = ?$ | $\frac{8 \times 18}{4 \times 2 \times 9} = ?$ | $\frac{9 \times 12}{3 \times 3 \times 4} = ?$ |

WRITTEN WORK.

1. A farmer sells 40 bushels of corn at 50 cents per bushel, and receives pay in cloth at 80 cents per yard; how many yards of cloth does he get?

By CANCELLATION.

ANALYSIS.

Value of 1 bu. corn = 50 cents

Value of 40 " " = $40 \times 50\phi$

As the value of 1 yd. cloth is 80¢, he gets as many times 1 yd. as $40 \times 50\phi$ contains 80¢, which is 25 times; he gets 25 yards.

The dividend is 2000 (cents) separated into factors. The divisor is 80 cents, but not separated into factors. Separate the divisor into factors, as below:

$$\frac{40 \times 50}{40 \times 2}$$

Cancel: the result is $\frac{50}{2} = 25$.

SHORTER PROCESS.

$$\frac{40 \times 50}{80} = \frac{25}{1} = 25.$$

Cancelling the factor 40, common to 40 and 80, of the 40 the factor 1 remains, and of the 80 the factor 2 remains; then cancelling the factor 2, common to 50 and 2, of the 50 the factor 25 remains, and of the 2 the factor 1 remains.

2. The factors of the dividend are 3, 2, 6, and 8; the factors of the divisor are 4 and 9. What is the quotient?

3. The factors of the dividend are 4, 5, 6, 7, and 8; the factors of the divisor are 14 and 9; what is the quotient?

Ans. $53\frac{1}{3}$.

By cancellation find the quotients:

- | | | |
|--------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------|
| 4. $\frac{32 \times 25}{5 \times 8}$ | 5. $\frac{56 \times 40 \times 9}{3 \times 14 \times 20}$ | 6. $\frac{27 \times 36 \times 15}{45 \times 12}$ |
| 7. $\frac{48 \times 70 \times 7}{35 \times 12 \times 14}$ | 8. $\frac{56 \times 32 \times 27}{16 \times 14 \times 9}$ | 9. $\frac{64 \times 27 \times 28}{18 \times 56 \times 16}$ |
| 10. $\frac{72 \times 81 \times 63}{126 \times 18 \times 15}$ | 11. $\frac{63 \times 77 \times 98}{27 \times 22 \times 14}$ | 12. $\frac{77 \times 76 \times 75}{44 \times 38 \times 25}$ |
| 13. $\frac{98 \times 62 \times 102}{42 \times 54 \times 34}$ | 14. $\frac{51 \times 63 \times 77}{55 \times 17 \times 21}$ | 15. $\frac{76 \times 82 \times 57}{19 \times 19 \times 164}$ |

PROPERTIES OF NUMBERS.



FACTORS. — DIVISORS. — MULTIPLES.

ORAL WORK.

1. In a box were 7 pairs of shoes and 1 odd shoe; how many shoes were in the box?
2. In a field were 6 pairs of doves, and there was 1 odd dove on a tree; how many doves?
3. Is 15 an even number or an odd number?
Is 16 an even number or an odd number?
4. Name three odd numbers. Three even numbers.
5. Name all the odd numbers below 10.
Name all the even numbers below 21.
6. What are the factors in multiplication?
What are the factors in division?
7. What two factors will make the product 6? The product 9? 12? 15? 21? 28? 25? 14? 18? 27? 33? 44? 55?
8. Of what two factors are the following products *composed*: 8? 16? 66? 49? 81? 45? 42? 77? 99? 100?
9. A product or number composed of two other numbers, or factors, is called a *composite number*. Name two factors of each of the following *composite numbers*: 10; 20; 22; 24; 39; 46; 48; 51; 57; 63; 93.
10. A number which has no factor except itself and 1 is called a *prime number*; as 3, 7, 11.
Name three prime numbers between 1 and 10.
11. Name four prime numbers between 10 and 20.
12. Name two prime numbers between 20 and 30.

DEFINITIONS.

An **Even Number** is a number that can be exactly divided by 2.

An **Odd Number** is a number that cannot be exactly divided by 2.

The **Factors** of a number are the numbers that, when multiplied together, make the given number.

Every factor of a number is an exact divisor of that number.

A **Prime Number** is a number which has no factors or exact divisors except itself and 1. It is always the **Multiple** of only itself and 1.

A **Composite Number** is the product of other numbers, and is a **Multiple** of any of its factors.

All numbers that are not prime are composite.

A **Prime Factor** is a factor which is a prime number.

A number is equal to the product of all its prime factors.

ORAL WORK.

1. Name the prime factors of 10; of 6; of 9.
2. Name the three prime factors of 8; of 27; of 12.
3. What number will exactly divide both 6 and 8?
4. What number is a factor of both 10 and 15?
5. What factor is common to 6 and 9?
6. Name two factors common to 15 and 30.
7. What is the highest factor common to 15 and 30?
8. (1) What composite number has 3 and 7 as its two factors?
(2) What composite number is composed of 6 and 7?
(3) Name a *multiple* of both 5 and 6.
(4) Name a number divisible by both 3 and 4.
(5) Name two divisors of 6; of 15; of 21; of 77.
(6) Name the greatest divisor common to 10 and 20.
9. (1) Name a *multiple* of both 4 and 5.
(2) What is the least number that is a *multiple* of both 3 and 6?
(3) Name the *Least Common Multiple* of 4 and 10.

FACTORS.

WRITTEN WORK.

1. Make a list of all the prime numbers below 100.
2. Find the prime factors of 210.

PROCESS.

$$\begin{array}{r|l} 2 & 210 \\ 3 & 105 \\ 5 & 35 \\ & 7 \end{array}$$

The prime factors of 210 are 2, 3, 5, and 7.

PROOF.

$$2 \times 3 \times 5 \times 7 = 210.$$

3. Find the prime factors of 4; of 16; of each composite number between 4 and 16.
4. Find the prime factors of 18; of 28; of each composite number between 18 and 28.
5. Find the prime factors of 30; of 40; of each composite number between 30 and 40.
6. Find the prime factors of 42; of 52; of each composite number between 42 and 52.
7. Find the prime factors of 54; of 65; of each composite number between 54 and 65.
8. Find the prime factors of 66; of 80; of each composite number between 66 and 80.
9. Find the prime factors of 81; of 100; of each composite number between 81 and 100.
10. Find the prime factors of 108; of 110; of 120.
11. Find the prime factors of 132; of 140; of 144.
12. Find the prime factors of 150; of 160; of 186.
13. Find the prime factors of 190; of 200; of 300.
14. Find the prime factors of 500; of 900; of 1 000.
15. Find the prime factors of 864; of 1 728.

COMMON FACTORS.

16. Find the prime factors common to 30 and 42.

PROCESS.

Prime factors of 30 = 2, 3, 5.

Prime factors of 42 = 2, 3, 7.

Prime factors common to 30 and 42 = 2, 3.

17. What prime factors are common to 45 and 75?
18. What are the common prime factors of 30, 60, and 90? Of 50, 125, and 150?
19. What is the Highest Common Factor of 84 and 144?

PROCESS.

Prime factors of 84 = 2, 2, 3, 7.

Prime factors of 144 = 2, 2, 2, 2, 3, 3.

The common prime factors = 2, 2, and 3.

Highest Common Factor of 84 and 144 = the product of 2, 2, and 3 = 12.

20. Find the Highest Common Factor of 48 and 96: of 21, 49, and 98.
21. Find the H. C. F. of 60 and 195. Of 96 and 140.
22. Find the H. C. F. of 24, 30, 72, and 126.

As a factor of a number is a divisor of that number, it follows that the Highest Common Factor of two or more numbers is their Greatest Common Divisor.

23. Find the Greatest Common Divisor of 45 and 165.
24. Find the G. C. D. of 176 and 220.
25. Find the G. C. D. of 72, 180, and 108. *Ans.* 36.
26. Find the G. C. D. of 26, 130, and 182.
27. Find the G. C. D. of 234 and 395.
28. Find the G. C. D. of 250, 750, and 1 000.
29. Find the G. C. D. of 324, 504, and 864. *Ans.* 36.
30. Find the G. C. D. of 20, 70, 180, 250, and 300.

Least Common Multiple.

A *Multiple* of a number is the product of the given number and some other factor.

A *Common Multiple* of two or more numbers is a multiple of which each of the numbers is a factor.

The *Least Common Multiple* of two or more numbers is the least multiple of which each of the numbers is a factor.

WRITTEN WORK.

1. Find the Least Common Multiple of 30 and 42.

EXPLANATION.

I. A multiple of 30 contains the prime factors of 30, which are 2, 3, 5.

II. A multiple of 42 contains the prime factors of 42, which are 2, 3, 7.

III. As the factors 2, 3, 5, 7 include the factors 2, 3, 5 and the factors 2, 3, 7, the product of 2, 3, 5, 7 is a common multiple of 30 and 42.

IV. As the prime factors 2, 3, 5, 7 include only the prime factors of 30 and 42, and each of those factors but once, the product of 2, 3, 5, 7 is the L. C. M. of 30 and 42.

PROCESS.

Prime factors of 30 = 2, 3, 5.

Prime factors of 42 = 2, 3, 7.

Prime factors of the

L. C. M. of 30 and 42 = 2, 3, 5, 7.

$2 \times 3 \times 5 \times 7 = 210$.

L. C. M. of 30 and 42 = 210.

Find the Least Common Multiple of :

2. 16 and 24.

5. 75 and 90.

8. 45 and 60.

3. 15 and 20.

6. 100 and 125.

9. 32 and 56.

4. 30 and 75.

7. 120 and 200.

10. 40 and 64.

11. Find the L. C. M. of 30, 42, and 54.

EXPLANATION.

The greatest number, 54, contains the factors 2, 3, 3, 3.

The number 42 contains the factor 7, not found in 54.

The number 30 contains the factor 5, not found in 54 or 42.

PROCESS.

Prime factors of 30 = 2, 3, 5.

" " " 42 = 2, 3, 7.

" " " 54 = 2, 3, 3, 3.

Prime factors of the L. C. M. of

30, 42, and 54 = 2, 3, 3, 3, 7, 5.

$2 \times 3 \times 3 \times 3 \times 7 \times 5 = 1890$.

L. C. M. of 30, 42, and 54 = 1890.

12. 8, 10, and 15.

19. 40, 200, and 300.

13. 16, 24, and 40.

20. 25, 35, and 45.

14. 20, 30, and 12.

21. 19, 76, and 190.

15. 18, 36, and 54.

22. 40, 32, and 256.

16. 25, 75, and 100.

23. 30, 75, and 81.

17. 32, 56, and 80.

24. 42, 60, and 70.

18. 23, 30, and 115.

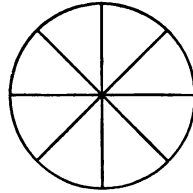
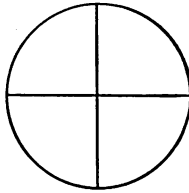
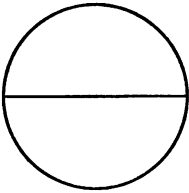
25. 55, 44, and 24.

REVIEW WORK. — Problems 7, 8, 9 in the Review following Multiplication.

FRACTIONS.



ORAL WORK.



1. Into how many parts is the first circle divided? Are the parts equal or unequal? What is each part called?

2. Into how many parts is the second circle divided? Are the parts equal or unequal? What is each part called? How much of the circle are two of the parts? How much of the circle are three of the parts? How much of the circle are four of the parts?

3. Into how many parts is the third circle divided? Are the parts equal or unequal? What is each part called? How much of the circle are two of its parts? Three of its parts? Four of its parts? Five of its parts? Six of its parts? Seven of its parts? Eight of its parts?

4. Fold a piece of paper so that three equal surfaces are shown. What is one of the parts, or surfaces, called? How much of the paper are two of its parts? Three of its parts?

5. If a yard of ribbon be cut into 5 equal parts, what is one part called? 3 parts?

6. If a melon be cut into 6 equal parts, what is one part called? 5 parts?

7. If an acre of land is divided into 7 equal parts, what is one part called? 6 parts?

REDUCTION OF FRACTIONS.

ORAL WORK.

1. In a garden there are 2 acres; how many half-acres in the garden? How many quarter-acres?
2. A man paid a quarter-dollar each for 8 books; how many dollars did he pay?
3. Four quarts make a gallon; how many quarts in $1\frac{1}{4}$ gallons? $2\frac{1}{4}$ gallons?
4. How many gallons are in 6 quarts? 7 quarts? 8 quarts? 10 quarts? 12 quarts?
5. A man bought 15 quarter-pound packages of soda; how many pounds did he buy?
6. How many days are $1\frac{1}{2}$ weeks? $1\frac{1}{4}$ weeks? $1\frac{3}{4}$ weeks?
7. How many weeks are 15 days? 16 days? 17 days?
8. What whole number is equal to $\frac{4}{4}$?
9. What whole number is equal to $1\frac{8}{9}$?
10. What mixed number is equal to $\frac{7}{4}$?
11. What mixed number is equal to $1\frac{3}{8}$?
12. What improper fraction equals $2\frac{1}{2}$?
13. What improper fraction equals $2\frac{1}{4}$?
14. What improper fraction equals $3\frac{1}{8}$?
15. Which is more, 1 half-dollar or 2 quarters?
16. How many fourths in a half?
17. How many halves in $\frac{4}{4}$? $\frac{6}{4}$? $\frac{8}{4}$? $1\frac{0}{4}$?
18. How many halves are in $\frac{8}{8}$? $\frac{4}{8}$? $1\frac{2}{8}$?
19. How many thirds are in $\frac{6}{6}$? $\frac{3}{6}$? $1\frac{2}{6}$? $\frac{2}{6}$?
20. Changing $\frac{1}{2}$ to fourths, how many fourths are found?
21. Reducing $\frac{4}{8}$ to fourths, how many fourths are found?
22. Change $1\frac{5}{4}$ to a whole number and fourths.
23. Reduce 4 to halves. Reduce 4 to fourths.
24. Change $4\frac{1}{4}$ to fourths. Reduce $5\frac{1}{3}$ to thirds.
25. Reduce $6\frac{1}{3}$ to an improper fraction.
26. Reduce $1\frac{7}{8}$ to a mixed number.
27. Reduce $\frac{2}{3}$ to sixths.
28. Change $\frac{4}{8}$ to thirds.

REDUCTION.

WRITTEN WORK.

Whole and Mixed Numbers to Improper Fractions.

1. How many fourths in 52? In
- $52\frac{3}{4}$
- ?

In 1 there are 4 fourths.

In 52 there are 52 times 4 fourths
= 208 fourths.The sum of 208 fourths and 3
fourths is 211 fourths.

$$1 = \frac{4}{4}.$$

$$52 = 52 \times \frac{4}{4} = \frac{208}{4}.$$

$$\frac{208}{4} + \frac{3}{4} = \frac{211}{4}.$$

2. A company owned
- $13\frac{1}{4}$
- blocks of ground; how many quarter-blocks?

Ans. 53 quarter-blocks.

3. Put 14 ounces of salt into quarter-ounce papers; how many papers?

Ans. 56 papers.

4. Reduce
- $32\frac{3}{4}$
- inches to quarter-inches.
- Ans.*
- 131 q.-in.

5. Mr. Coke had
- $38\frac{3}{8}$
- miles of fencing; a furlong is an eighth of a mile; how many furlongs of fencing did Mr. Coke have?

Ans. 307 furlongs.

6. An ounce of lead is
- $\frac{1}{16}$
- of a pound; how many ounces are in
- $16\frac{3}{16}$
- lb. lead?

Ans. 259 oz.

Reduce to improper fractions:

7. $39\frac{2}{3}$.	<i>Ans.</i> $\frac{119}{3}$.	19. $227\frac{5}{6}$.	<i>Ans.</i> $\frac{2048}{3}$.
8. $103\frac{1}{2}$.	<i>Ans.</i> $\frac{207}{2}$.	20. $523\frac{3}{11}$.	<i>Ans.</i> $\frac{5756}{11}$.
9. $137\frac{2}{3}$.	<i>Ans.</i> $\frac{262}{3}$.	21. $672\frac{4}{5}$.	<i>Ans.</i> $\frac{10084}{5}$.
10. $98\frac{3}{5}$.	<i>Ans.</i> $\frac{493}{5}$.	22. $713\frac{6}{13}$.	<i>Ans.</i> $\frac{2275}{13}$.
11. $274\frac{5}{6}$.	<i>Ans.</i> $\frac{1649}{6}$.	23. $357\frac{7}{8}$.	<i>Ans.</i> —.
12. $378\frac{5}{7}$.	<i>Ans.</i> $\frac{2651}{7}$.	24. $220\frac{3}{8}$.	<i>Ans.</i> $\frac{3523}{8}$.
13. $217\frac{3}{8}$.	<i>Ans.</i> $\frac{1739}{8}$.	25. $110\frac{5}{8}$.	<i>Ans.</i> —.
14. $196\frac{5}{8}$.	<i>Ans.</i> $\frac{1573}{8}$.	26. $314\frac{5}{8}$.	<i>Ans.</i> —.
15. $201\frac{3}{4}$.	<i>Ans.</i> $\frac{807}{4}$.	27. $175\frac{7}{8}$.	<i>Ans.</i> —.
16. $315\frac{2}{3}$.	<i>Ans.</i> $\frac{247}{3}$.	28. $561\frac{5}{8}$.	<i>Ans.</i> $\frac{911}{8}$.
17. $198\frac{4}{5}$.	<i>Ans.</i> $\frac{994}{5}$.	29. $22\frac{3}{4}$.	<i>Ans.</i> —.
18. $297\frac{5}{8}$.	<i>Ans.</i> $\frac{1787}{8}$.	30. $1091\frac{3}{4}$.	<i>Ans.</i> $\frac{2301}{4}$.

To reduce a mixed number to an improper fraction:

To the given fraction add the whole number reduced to a like fraction.

Improper Fractions to Whole or Mixed Numbers.

1. Reduce
- $\frac{208}{4}$
- to a whole number.

4 fourths = 1 unit.

208 fourths = as many times 1 unit as 208

contains 4.

208 contains 4 52 times.

 52×1 unit = 52 units.

$$\frac{208}{4} = 208 \div 4 = 52.$$

2. How many dollars in 72 half-dollars?
- Ans.*
- 36 dollars.

3. How many tons of coal in 172 quarter-tons?

Ans. 43 T.

4. How many units are in
- $\frac{420}{3}$
- ?

Ans. 140 units.

5. In 37 quarter-yards how many yards?

4 quarter-yards = 1 yd.

37 quarter-yards = as many times 1 yd. as 37

contains 4.

37 contains 4 $9\frac{1}{4}$ times. $9\frac{1}{4} \times 1$ yd. = $9\frac{1}{4}$ yd.

$$\frac{37}{4} = 37 \div 4 = 9\frac{1}{4}.$$

6. If each of 306 iron castings weighs
- $\frac{1}{3}$
- of a ton, what is the weight of all?
- Ans.*
- 34 T.

7. A merchant sold 1877 boxes of strawberries, each box being
- $\frac{1}{4}$
- of a crate; how many crates of berries did he sell?

Ans. $78\frac{5}{4}$ crates.

Reduce to whole or mixed numbers :

8. $\frac{528}{5}$.	<i>Ans.</i> 88.	17. $\frac{1225}{25}$.	<i>Ans.</i> —.
9. $\frac{879}{3}$.	<i>Ans.</i> —.	18. $\frac{948}{24}$.	<i>Ans.</i> $39\frac{1}{2}$.
10. $\frac{427}{2}$.	<i>Ans.</i> $53\frac{1}{2}$.	19. $\frac{500}{11}$.	<i>Ans.</i> —.
11. $\frac{322}{7}$.	<i>Ans.</i> —.	20. $\frac{700}{40}$.	<i>Ans.</i> $17\frac{1}{2}$.
12. $\frac{1881}{9}$.	<i>Ans.</i> 209.	21. $\frac{324}{18}$.	<i>Ans.</i> —.
13. $\frac{1728}{12}$.	<i>Ans.</i> —.	22. $\frac{984}{22}$.	<i>Ans.</i> $44\frac{8}{11}$.
14. $\frac{424}{15}$.	<i>Ans.</i> $28\frac{4}{15}$.	23. $\frac{984}{82}$.	<i>Ans.</i> $36\frac{3}{41}$.
15. $\frac{361}{16}$.	<i>Ans.</i> —.	24. $\frac{3000}{60}$.	<i>Ans.</i> —.
16. $\frac{256}{32}$.	<i>Ans.</i> —.	25. $\frac{3000}{76}$.	<i>Ans.</i> —.

To reduce an improper fraction to a whole or a mixed number :

Divide the numerator of the fraction by the denominator.

Fractions to Lowest Terms.

1. Reduce $\frac{20}{30}$ to lowest terms by cancelling.

PROCESS.
$$\frac{20}{30} = \frac{2}{3}.$$

2. Reduce $\frac{30}{40}$ to lowest terms by cancelling. *Ans.* $\frac{3}{4}$.
 3. Reduce $\frac{4}{6}$ to lowest terms by cancelling. *Ans.* $\frac{2}{3}$.
 4. Reduce $\frac{5}{8}$ to lowest terms by cancelling. *Ans.* $\frac{5}{8}$.
 5. Reduce $\frac{8}{12}$ to lowest terms by cancelling. *Ans.* $\frac{2}{3}$.
 6. Reduce $\frac{10}{15}$ to lowest terms by cancelling. *Ans.* $\frac{2}{3}$.
 7. Reduce $\frac{40}{60}$ to lowest terms, cancelling *two* factors.

PROCESS.
$$\frac{40}{60} = \frac{4}{6} = \frac{2}{3}.$$

8. Reduce $\frac{80}{120}$ to lowest terms, cancelling two factors.

Reduce to lowest terms:

9. $\frac{6}{8}$; $\frac{12}{16}$; $\frac{24}{32}$; $\frac{48}{64}$; $\frac{36}{48}$; $\frac{72}{96}$. *Ans. for each* $\frac{3}{4}$.
 10. $\frac{2}{3}$; $\frac{8}{12}$; $\frac{4}{6}$; $\frac{6}{9}$; $\frac{40}{60}$; $\frac{16}{24}$; $\frac{42}{63}$. *Ans. for each* $\frac{1}{3}$.
 11. $\frac{84}{126}$; $\frac{28}{42}$; $\frac{4}{6}$; $\frac{12}{18}$; $\frac{20}{30}$; $\frac{16}{24}$; $\frac{8}{12}$. *Ans. for each* $\frac{2}{3}$.
 12. $\frac{36}{126}$; $\frac{12}{42}$; $\frac{16}{56}$; $\frac{48}{168}$; $\frac{64}{224}$; $\frac{84}{294}$. *Ans. for each* $\frac{2}{7}$.
 13. $\frac{120}{820}$; $\frac{60}{160}$; $\frac{54}{144}$; $\frac{18}{48}$; $\frac{9}{24}$; $\frac{68}{168}$. *Ans. for each* $\frac{3}{8}$.

To reduce a fraction to its lowest terms:

Cancel the factors common to the terms of the fraction.

Fractions to Higher Terms.

1. Multiply both numerator and denominator of the fraction $\frac{3}{4}$ by the factor 7. *Ans.* $\frac{21}{28}$.
 2. Multiply both terms of the fraction $\frac{3}{4}$ by the factor 8. *Ans.* $\frac{24}{32}$.
 3. Multiply each term of the fraction $\frac{3}{4}$, which is the answer to No. 9 in Reduction to Lowest Terms, by the factor that was cancelled in finding the lowest terms of $\frac{6}{8}$. *Ans.* $\frac{6}{8}$.

4. Reduce $\frac{5}{8}$ to 24ths.

$$1 = \frac{24}{24}; \frac{1}{8} = \frac{1}{8} \text{ of } \frac{24}{24} = \frac{3}{24}; \frac{5}{8} = 5 \times \frac{3}{24} = \frac{15}{24}.$$

5. Reduce to a fraction which has 24 for a denominator the fraction $\frac{1}{2}$; the fraction $\frac{1}{3}$; the fraction $\frac{2}{3}$.

6. Reduce to a fraction which has 32 for a denominator the fraction $\frac{3}{8}$; the fraction $\frac{3}{4}$; the fraction $\frac{3}{16}$.

7. Reduce to a fraction which has 36 for a denominator the fraction $\frac{4}{9}$; the fraction $\frac{5}{18}$; the fraction $\frac{3}{4}$.

To reduce a fraction to higher terms :

Multiply both terms by that number which will raise the denominator to the required denominator.

Least Common Denominator.

1. Reduce to two fractions each having 6 for a denominator, the fractions $\frac{1}{2}$ and $\frac{1}{3}$.

2. Reduce $\frac{1}{2}$ and $\frac{1}{3}$ to tenths.

3. Reduce $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ to twelfths.

4. Reduce $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{1}{5}$ to sixtieths.

5. Reduce $\frac{3}{4}$, $\frac{2}{3}$, and $\frac{1}{10}$ to twentieths.

6. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{2}{15}$ to thirtieths.

7. Reduce $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having the same denominator.

8. Reduce to a common denominator $\frac{2}{3}$ and $\frac{3}{5}$.

9. Find the Least Common Multiple of 10 and 8.

10. Reduce $\frac{1}{10}$ and $\frac{1}{8}$ to fractions having the least common denominator.

11. Find the Least Common Multiple of 10, 8, and 6.

12. Reduce $\frac{1}{10}$, $\frac{1}{8}$, and $\frac{1}{6}$ to fractions having the least common denominator.

13. Find the Least Common Multiple of 12, 5, and 7.

14. Reduce $\frac{1}{12}$, $\frac{1}{5}$, and $\frac{1}{7}$ to fractions having the least common denominator.

15. Reduce to a common denominator $\frac{2}{12}$, $\frac{2}{5}$, and $\frac{2}{7}$.

16. Reduce to a common denominator $\frac{3}{10}$, $\frac{3}{8}$, and $\frac{1}{6}$.

17. Reduce to a common denominator $\frac{2}{3}$, $\frac{2}{5}$, and $\frac{5}{8}$.

Reduce to equivalent fractions having the least common denominator:

- | | | |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------|
| 18. $\frac{2}{5}, \frac{3}{4}, \frac{3}{7}$. | 27. $\frac{5}{16}, \frac{4}{9}, \frac{1}{4}$. | 36. $\frac{3}{4}, \frac{2}{3}, \frac{4}{5}, \frac{5}{8}$. |
| 19. $\frac{3}{5}, \frac{4}{7}, \frac{5}{8}$. | 28. $\frac{3}{8}, \frac{5}{9}, \frac{1}{5}$. | 37. $\frac{2}{3}, \frac{3}{4}, \frac{5}{8}, \frac{4}{7}$. |
| 20. $\frac{4}{7}, \frac{5}{8}, \frac{7}{9}$. | 29. $\frac{1}{10}, \frac{1}{6}, \frac{1}{8}$. | 38. $\frac{1}{2}, \frac{3}{8}, \frac{1}{16}, \frac{2}{7}$. |
| 21. $\frac{3}{8}, \frac{8}{9}, \frac{9}{10}$. | 30. $\frac{1}{20}, \frac{2}{3}, \frac{1}{8}$. | 39. $\frac{2}{3}, \frac{1}{6}, \frac{3}{8}, \frac{1}{16}$. |
| 22. $\frac{5}{9}, \frac{3}{7}, \frac{3}{5}$. | 31. $\frac{4}{5}, \frac{1}{20}, \frac{2}{3}$. | 40. $\frac{1}{5}, \frac{2}{9}, \frac{3}{8}, \frac{1}{2}$. |
| 23. $\frac{1}{4}, \frac{3}{8}, \frac{5}{32}$. | 32. $\frac{1}{16}, \frac{1}{20}, \frac{4}{5}$. | 41. $\frac{4}{5}, \frac{3}{7}, \frac{1}{10}, \frac{1}{8}$. |
| 24. $\frac{3}{16}, \frac{1}{8}, \frac{7}{32}$. | 33. $\frac{3}{5}, \frac{3}{7}, \frac{1}{20}$. | 42. $\frac{7}{9}, \frac{1}{2}, \frac{7}{8}, \frac{1}{4}$. |
| 25. $\frac{4}{7}, \frac{1}{14}, \frac{3}{21}$. | 34. $\frac{1}{32}, \frac{1}{8}, \frac{2}{7}$. | 43. $\frac{2}{3}, \frac{5}{9}, \frac{5}{8}, \frac{5}{7}$. |
| 26. $\frac{3}{8}, \frac{2}{9}, \frac{1}{20}$. | 35. $\frac{5}{8}, \frac{2}{3}, \frac{3}{8}$. | 44. $\frac{3}{4}, \frac{4}{7}, \frac{5}{8}, \frac{1}{9}$. |

To reduce fractions to fractions having the Least Common Denominator:

Reduce each fraction to a fraction whose denominator is the Least Common Multiple of the denominators of the given fractions.

ADDITION OF FRACTIONS.

WRITTEN WORK.

1. A farmer has $\frac{2}{7}$ of his land in corn, and $\frac{3}{7}$ of his land in cotton; how much of his land has he in corn and cotton?

PROCESS. $\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$.

2. Add $\frac{1}{12}, \frac{5}{12}, \frac{7}{12}$, and $1\frac{1}{2}$.

PROCESS. $\frac{1}{12} + \frac{5}{12} + \frac{7}{12} + 1\frac{1}{2} = 2\frac{1}{2}$.

3. Add $\frac{1}{15}, \frac{2}{15}, \frac{4}{15}, \frac{7}{15}, \frac{8}{15}$, and $1\frac{1}{5}$.

Ans. $2\frac{3}{5}$, or $2\frac{1}{5}$.

4. Find the sum of $\frac{1}{2}, \frac{3}{8}$, and $\frac{7}{10}$.

EXPLANATION.

PROCESS.

Reducing the fractions to equivalent fractions having the same denominator, the sum of the fractions is found to be $1\frac{8}{10}$. Reducing the improper fraction $1\frac{8}{10}$ to a mixed number, the result is $1\frac{4}{5}$. Reducing the $\frac{4}{5}$ to its lowest terms, the final result is $1\frac{4}{5}$.

5. A man worked $\frac{5}{12}$ of his garden on Monday, and $\frac{8}{15}$ of it on Tuesday; what part of his garden did he work both days?

Ans. $\frac{19}{20}$ of his garden.

6. Find the sum of $\frac{3}{8}$, $\frac{4}{7}$, and $\frac{3}{4}$.

Ans. $1\frac{11}{8}$.

Find the sum :

7. $\frac{1}{2} + \frac{2}{3} + \frac{3}{4}$. Ans. $1\frac{11}{12}$.

12. $\frac{5}{12} + \frac{9}{16} + \frac{7}{24}$. Ans. $1\frac{13}{8}$.

8. $\frac{2}{3} + \frac{3}{4} + \frac{5}{6}$. Ans. $2\frac{1}{6}$.

13. $\frac{8}{15} + \frac{2}{3} + \frac{7}{9} + \frac{3}{5}$. Ans. $2\frac{2}{3}$.

9. $\frac{1}{21} + \frac{5}{6} + \frac{4}{7}$. Ans. $1\frac{37}{42}$.

14. $\frac{2}{5} + \frac{1}{4} + \frac{3}{20} + \frac{9}{25}$. Ans. $1\frac{4}{25}$.

10. $\frac{4}{7} + \frac{5}{8} + \frac{7}{16}$. Ans. $1\frac{71}{112}$.

15. $\frac{3}{20} + \frac{5}{70}$. Ans. $1\frac{8}{70}$.

11. $\frac{7}{8} + \frac{9}{10} + \frac{7}{12}$. Ans. $2\frac{43}{120}$.

16. $\frac{3}{80} + \frac{4}{90} + \frac{1}{2}$. Ans. $1\frac{13}{720}$.

17. What is the sum of $3\frac{7}{12}$ and $9\frac{4}{5}$?

$$3\frac{7}{12} = 3\frac{35}{60}$$

$$9\frac{4}{5} = 9\frac{48}{60}$$

PROCESS.

$$3\frac{7}{12} + 9\frac{4}{5} = 12\frac{83}{60} = 13\frac{23}{60}.$$

18. In one bin there are $278\frac{3}{8}$ bu. wheat, in another 500 bu., in a third $652\frac{5}{8}$ bu.; how many bushels in the three bins?

Ans. $1431\frac{3}{8}$ bu.

Find the sum :

19. $17\frac{1}{2} + 46\frac{4}{5}$. Ans. $64\frac{9}{10}$.

23. $18\frac{1}{8} + 27\frac{4}{5}$. Ans. $46\frac{43}{40}$.

20. $29\frac{3}{7} + 42\frac{5}{8}$. Ans. $72\frac{3}{56}$.

24. $54\frac{5}{9} + 45\frac{1}{8}$. Ans. $100\frac{1}{72}$.

21. $44\frac{3}{8} + 36\frac{7}{8}$. Ans. $81\frac{1}{2}$.

25. $83\frac{1}{2} + 15\frac{4}{5}$. Ans. $99\frac{9}{10}$.

22. $56\frac{7}{9} + 78\frac{5}{12}$. Ans. $135\frac{7}{6}$.

26. $57\frac{1}{6} + 56\frac{7}{8}$. Ans. $114\frac{11}{24}$.

27. $201\frac{3}{4} + 38\frac{7}{8}$.

Ans. $240\frac{5}{8}$.

28. $32\frac{2}{3} + 71\frac{3}{8} + 52\frac{1}{2}$.

Ans. $157\frac{1}{8}$.

29. $78 + 37\frac{4}{5} + 124\frac{7}{8}$.

Ans. $240\frac{17}{40}$.

30. $\$400 + \$319\frac{3}{4} + \$276\frac{1}{2}$.

Ans. $\$996\frac{1}{2}$.

31. $160 + 52\frac{1}{2} + 37\frac{9}{10}$.

Ans. $250\frac{49}{20}$.

32. $76\frac{1}{8} + 31\frac{1}{5} + 70\frac{1}{2}$.

Ans. $178\frac{17}{40}$.

33. $50\frac{1}{2} + 65\frac{2}{3} + 75\frac{3}{4}$.

Ans. $191\frac{1}{2}$.

34. $89\frac{3}{4} + 97\frac{4}{5} + 21\frac{5}{6}$.

Ans. $209\frac{23}{60}$.

35. $21\frac{5}{6} + 37\frac{3}{4} + 42\frac{5}{8}$.

Ans. $102\frac{5}{24}$.

36. $42\frac{5}{8} + 44\frac{7}{9} + 1\frac{1}{10}$.

Ans. $87\frac{881}{720}$.

To add fractions having different denominators :

Reduce the fractions to fractions having the least common denominator.

Write the sum of the new numerators over the common denominator.

REVIEW WORK. — 5, 6, 7, Review after Division.

SUBTRACTION OF FRACTIONS.

WRITTEN WORK.

1. Find the difference of
- $\frac{17}{8}$
- and
- $\frac{3}{4}$
- .

EXPLANATION.

The fractions reduced to fractions having the least common denominator are $\frac{17}{8}$ for the minuend, and $\frac{3}{4}$ for the subtrahend. The difference is $\frac{7}{8}$.

PROCESS.

$$\begin{array}{r} \frac{17}{8} = \frac{17}{8} \\ \frac{3}{4} = \frac{6}{8} \\ \hline \frac{17}{8} - \frac{6}{8} = \frac{11}{8} \end{array}$$

2. A field is
- $\frac{15}{8}$
- mile long, and
- $\frac{7}{2}$
- mile wide; how much greater is its length than its breadth?
- Ans.*
- $\frac{17}{8}$
- mi.

3. A merchant sold to two customers
- $\frac{35}{6}$
- of a bolt of jeans; to one he sold
- $\frac{3}{4}$
- of the bolt; what part of the bolt did he sell to the other?
- Ans.*
- $\frac{1}{6}$
- of it.

4. Find the difference of 13 and
- $\frac{5}{7}$
- .

EXPLANATION.

Reduce one of the units of the minuend to a fraction having the same denominator as the subtrahend.

PROCESS.

$$\begin{array}{r} 13 = 12\frac{7}{7} \\ \frac{5}{7} \\ \hline 12\frac{7}{7} - \frac{5}{7} = 12\frac{2}{7} \end{array}$$

5. The length of a rod is 17 feet less
- $\frac{1}{2}$
- foot; how many feet in a rod?

6. A man had \$134
- $\frac{1}{2}$
- , and spent \$59
- $\frac{3}{4}$
- ; how much money did he then have?

EXPLANATION.

Change \$1 of the minuend to quarter-dollars; \$1 = \$ $\frac{4}{4}$; \$ $\frac{1}{2}$ = $\frac{2}{4}$; the minuend is now \$133 $\frac{3}{4}$.

PROCESS.

$$\begin{array}{r} \$134\frac{1}{2} = \$133\frac{3}{4} \\ 59\frac{3}{4} \\ \hline \$134\frac{1}{2} - \$59\frac{3}{4} = \$74\frac{3}{4} \end{array}$$

7. Find the difference of 42 and $\frac{15}{8}$. *Ans.* $41\frac{1}{8}$.
 8. Find the difference of $42\frac{1}{4}$ and $39\frac{3}{4}$. *Ans.* $2\frac{1}{2}$.
 9. Find the difference of $63\frac{3}{8}$ and $57\frac{7}{8}$. *Ans.* $5\frac{1}{2}$.
 10. Find the difference of $20\frac{1}{16}$ and $10\frac{3}{16}$. *Ans.* $9\frac{7}{16}$.
 11. $50\frac{5}{32} - 1\frac{13}{32} = ?$ 12. $121\frac{7}{8} - 71\frac{5}{8} = ?$ 13. $63\frac{1}{2} - 13\frac{3}{8} = ?$
Ans. to each $49\frac{3}{4}$.

To subtract fractions having different denominators :

Reduce the fractions to fractions having the least common denominator. Write the difference of the new numerators over the common denominator.

REVIEW.

1. Mr. Brown had \$12 in paper money, and $\$3\frac{1}{4}$ in coin; he spent $\$7\frac{3}{4}$; how much did he then have? *Ans.* $\$7\frac{1}{2}$.

2. A farmer sowed a 50-acre field in grain of three kinds; $16\frac{2}{3}$ acres he sowed in wheat, $16\frac{2}{3}$ acres in oats, and how many acres in rye? *Ans.* —.

3. Three cars are loaded with 41 tons of freight; in one car there are $13\frac{7}{8}$ T., in another $14\frac{1}{8}$ T.; how many tons in the third car? *Ans.* $14\frac{1}{8}$ T.

4. A man walked $10\frac{7}{8}$ miles in 3 hours; the first hour he walked $3\frac{2}{8}$ miles, the second $3\frac{1}{8}$ miles; how far did he walk the third hour? *Ans.* $3\frac{7}{8}$ mi.

5. In 3 hours a river rose $7\frac{3}{10}$ feet; the first hour it rose $3\frac{1}{5}$ ft., the second hour $3\frac{1}{5}$ ft.; how much the third hour? *Ans.* $\frac{1}{5}$.

6. A quart of corn weighs $1\frac{3}{8}$ lb., a quart of oats 1 lb., a quart of meal $1\frac{1}{2}$ lb. A man feeds his horse on a mixture of meal, oats, and corn, one quart of each; how many pounds does he give the horse? *Ans.* $3\frac{1}{8}$ lb.

7. The minuend is $27\frac{2}{5} + 13\frac{4}{5}$; the subtrahend is $16\frac{3}{5} + 15\frac{4}{5}$; what is the remainder? *Ans.* $8\frac{4}{5}$.

8. A farmer ploughed $36\frac{7}{8}$ acres of land in three weeks; the first week he ploughed $14\frac{1}{4}$ acres, the second week $13\frac{1}{2}$ acres; how many acres did he plough the third week? *Ans.* $9\frac{7}{4}$ A.

9. The minuend is $87\frac{1}{3} + 12\frac{2}{3}$; the subtrahend is $16\frac{2}{3} + 33\frac{1}{3}$; what is the remainder? *Ans.* —.

10. A butcher had 2 quarters of beef; one weighed $73\frac{3}{4}$ lb., the other $72\frac{3}{4}$ lb.; he sold $69\frac{1}{4}$ lb. in the forenoon, and the remainder in the afternoon; how many pounds did he sell in the afternoon? *Ans.* $77\frac{1}{4}$ lb.

11. The minuend is $42\frac{3}{8} + 56\frac{7}{12}$; the subtrahend is $21\frac{1}{3} + 5\frac{3}{4}$; what is the remainder? *Ans.* $72\frac{1}{6}$.

MULTIPLICATION OF FRACTIONS.

ORAL WORK.

1. How much money is $\frac{1}{2}$ of 50 cents?
2. Each of 4 boys has $\frac{1}{2}$ bu. pecans; how many bushels do the 4 boys have?
3. Each of 4 boys has $2\frac{1}{2}$ bu. pecans; how many bushels do the 4 boys have?
4. If a man works for \$1 $\frac{1}{4}$ per day, how much will he earn in 2 days? In 3 days? In 4 days?
5. If a boy works for $\frac{1}{4}$ of a dollar per day, how much will he earn in 2 days? In 3 days? In 4 days?
6. What is $\frac{1}{3}$ of 3? $\frac{1}{3}$ of 6? $\frac{1}{3} \times 9$? $\frac{1}{3} \times 12$?
7. What is $\frac{1}{5}$ of 10? $\frac{1}{5} \times 15$? $\frac{1}{5} \times 16$? $\frac{1}{5} \times 17$?
8. What is $\frac{1}{6} \times 12$? $\frac{2}{6} \times 12$? $\frac{3}{6} \times 12$? $\frac{5}{6} \times 12$?
9. How many sixths are 12 times one-sixth?
10. What part of a dollar is $\frac{1}{2}$ of $\frac{1}{2}$ a dollar?
11. How many eighths make a fourth?
12. How many eighths make $\frac{3}{4}$?
13. How many fourths make a unit?
14. How many sixteenths make a unit?
15. How many fourths are 4 times $\frac{1}{16}$?
16. How many halves are 4 times $\frac{1}{4}$?
17. How many fourths are 4 times $\frac{3}{4}$?
18. How many fourths are 4 times $\frac{3}{8}$?
19. How many fourths are $4 \times \frac{5}{8}$?
20. How many eighths is $\frac{1}{2}$ of $\frac{3}{4}$?
21. How many eighths is $\frac{1}{2} \times \frac{1}{4}$?
22. How many sixteenths is $\frac{1}{4}$ of $\frac{3}{4}$?
23. How many sixteenths is $\frac{1}{2}$ of $\frac{3}{4}$?
24. How many sixteenths is $\frac{3}{4}$ of $\frac{3}{4}$?
25. How many twelfths is $\frac{1}{3}$ of $\frac{3}{4}$? $\frac{2}{3} \times \frac{3}{4}$? $\frac{1}{4} \times \frac{3}{3}$?
26. How many fifteenths is $\frac{1}{3}$ of $\frac{3}{4}$? $\frac{2}{3} \times \frac{3}{4}$? $\frac{4}{5} \times \frac{3}{5}$?

(After a fraction the sign (\times) is read of.)

*Fractions Multiplied by Whole Numbers.***WRITTEN WORK.**

1. A farmer uses $\frac{7}{8}$ bu. meal per day; how many bushels will he use in 30 days?

Meal used in 1 day = $\frac{7}{8}$ bu.

Meal used in 30 days = $30 \times \frac{7}{8}$ bu.

$30 \times \frac{7}{8}$ bu. = $26\frac{1}{4}$ bu.

Meal used in 30 days = $26\frac{1}{4}$ bu.

$$30 \times \frac{7}{8} \text{ bu.} = 26\frac{1}{4} \text{ bu.} = 26\frac{1}{4} \text{ bu.}$$

2. Mary walks $\frac{3}{4}$ of a mile to school; how many miles does she walk in five days, going and coming once per day?

Ans. $7\frac{1}{2}$ mi.

3. A wagoner hauls at each load $1\frac{5}{8}$ of a ton; how many tons does he haul in 24 loads?

Ans. $22\frac{1}{2}$ T.

4. If a horse eats $1\frac{5}{8}$ bu. corn per week, how many bushels does he eat in 52 wk.?

$$52 \times 1\frac{5}{8} = 52 \times 1 + 52 \times \frac{5}{8}.$$

$$52 \times 1 = 52.$$

$$52 \times \frac{5}{8} = 26\frac{1}{2} = 32\frac{1}{2}.$$

$$52 + 32\frac{1}{2} = 84\frac{1}{2}.$$

$$1\frac{5}{8}$$

$$\underline{52}$$

$$52$$

$$\underline{32\frac{1}{2}}$$

$$84\frac{1}{2}$$

5. If a man walks $3\frac{4}{5}$ mi. per hour, how many miles does he walk in 9 hr.?

Ans. 31 mi.

Multiply:

- | | | | |
|-----------------------------|---------------------------------|-----------------------------|----------------------------------|
| 6. $16\frac{2}{7}$ by 6. | <i>Ans.</i> $101\frac{1}{7}$. | 11. $54\frac{3}{17}$ by 21. | <i>Ans.</i> $1137\frac{1}{17}$. |
| 7. $17\frac{3}{8}$ by 9. | <i>Ans.</i> $156\frac{3}{8}$. | 12. $65\frac{5}{8}$ by 25. | <i>Ans.</i> $1628\frac{3}{8}$. |
| 8. $21\frac{1}{9}$ by 8. | <i>Ans.</i> $171\frac{1}{9}$. | 13. $76\frac{9}{16}$ by 34. | <i>Ans.</i> $2603\frac{1}{16}$. |
| 9. $34\frac{5}{12}$ by 11. | <i>Ans.</i> $378\frac{7}{12}$. | 14. $89\frac{1}{3}$ by 42. | <i>Ans.</i> $3755\frac{1}{3}$. |
| 10. $43\frac{3}{16}$ by 13. | <i>Ans.</i> $561\frac{7}{16}$. | 15. $97\frac{5}{16}$ by 55. | <i>Ans.</i> $5352\frac{3}{16}$. |

Whole Numbers Multiplied by Fractions.

1. If a ship sails 15 miles per hour, how many miles does she sail in $\frac{2}{3}$ of an hour?

Distance made in 1 hour = 15 miles.

" " " $\frac{1}{3}$ " = $\frac{1}{3}$ of 15 mi. = 5 mi.

" " " $\frac{2}{3}$ " = 2×5 mi. = 10 mi.

$$\frac{2}{3} \times 15 = \frac{30}{3} = 10.$$

2. A miller gives, in the form of meal, $\frac{2}{3}$ of the corn received; when he receives a bushel weighing 56 lb., how many pounds of meal does he give? *Ans.* 48 lb.

3. There are 1760 yd. in a mile; how many yards are in $\frac{7}{8}$ mi.? *Ans.* 1540 yd.

4. How many cents make $\frac{1}{10}$ of a dollar? *Ans.* 85¢.

5. How many pounds of meal make $\frac{1}{3}$ of a bushel? *Ans.* 39 lb.

Multiply:

- | | | | |
|-----------------------------|------------------|------------------------------|----------------------------------|
| 6. 28 by $\frac{2}{7}$. | <i>Ans.</i> 24. | 11. 2015 by $\frac{3}{8}$. | <i>Ans.</i> 1209. |
| 7. 36 by $\frac{4}{9}$. | <i>Ans.</i> 16. | 12. 3007 by $\frac{3}{8}$. | <i>Ans.</i> 2672 $\frac{3}{8}$. |
| 8. 56 by $\frac{7}{8}$. | <i>Ans.</i> 49. | 13. 5103 by $\frac{5}{8}$. | <i>Ans.</i> 2835. |
| 9. 112 by $\frac{3}{16}$. | <i>Ans.</i> 21. | 14. 1890 by $\frac{7}{12}$. | <i>Ans.</i> 1102 $\frac{1}{2}$. |
| 10. 224 by $\frac{1}{32}$. | <i>Ans.</i> 105. | 15. 1900 by $\frac{3}{16}$. | <i>Ans.</i> 356 $\frac{1}{4}$. |

Cancel, and multiply:

16. Multiply $\frac{4}{7}$ by 28. $\frac{28}{1} \times \frac{4}{7}$, or $\frac{\overset{4}{\cancel{28}} \times 4}{\underset{1}{\cancel{7}}} = \frac{16}{1} = 16.$

17. Multiply 36 by $\frac{4}{9}$. $\frac{4}{9} \times 36 = \frac{4 \times \overset{4}{\cancel{36}}}{\underset{1}{\cancel{9}}} = 16.$

18. Multiply 24 by $\frac{2}{3}$. $\frac{2}{3} \times \overset{8}{\frac{24}{1}} = \frac{16}{1} = 16.$

19. Multiply 27 by $\frac{2}{3}$. *Ans.* _____.

Fractions Multiplied by Fractions.

- | | |
|-------------------------------------------------------------------|------------------------------|
| 1. Multiply $\frac{1}{3}$ by $\frac{3}{4}$, cancelling factors. | <i>Ans.</i> $\frac{1}{4}$. |
| 2. Multiply $\frac{2}{3}$ by $\frac{3}{4}$, cancelling factors. | <i>Ans.</i> $\frac{1}{2}$. |
| 3. Multiply $\frac{3}{8}$ by $\frac{1}{8}$, cancelling factors. | <i>Ans.</i> $\frac{1}{16}$. |
| 4. Multiply $\frac{5}{8}$ by $\frac{3}{25}$, cancelling factors. | <i>Ans.</i> $\frac{1}{10}$. |
| 5. Multiply $\frac{3}{7}$ by $\frac{1}{14}$, cancelling factors. | <i>Ans.</i> $\frac{1}{28}$. |

6. What is $\frac{3}{4}$ of $\frac{1}{2}$?

$$\frac{1}{4} \text{ of } \frac{1}{2} = \frac{1}{8}.$$

$$\frac{3}{4} \text{ of } \frac{1}{2} = 3 \times \frac{1}{8} = \frac{3}{8}.$$

$$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}.$$

7. A clerk drew $\frac{3}{4}$ of his month's salary; he spent $\frac{1}{3}$ of the money for clothing, and placed $\frac{2}{3}$ of it in bank; what part of his month's salary did he place in bank?

$$\frac{1}{3} \text{ of } \frac{3}{4} \text{ of salary} = \frac{1}{4} \text{ of salary.}$$

$$\frac{2}{3} \text{ of } \frac{3}{4} \text{ of salary} = 2 \times \frac{1}{4} \text{ of salary.}$$

$$2 \times \frac{1}{4} \text{ of salary} = \frac{2}{4} \text{ or } \frac{1}{2} \text{ of salary.}$$

$$\frac{1}{3} \times \frac{3}{4} = \frac{1}{4}.$$

8. Multiply $\frac{3}{16}$ by $\frac{2}{3}$.

Ans. $\frac{1}{8}$.

Multiply the following, cancelling where possible.

9. $\frac{5}{14} \times \frac{7}{8}$. Ans. $\frac{5}{16}$. 14. $\frac{1}{3} \times \frac{3}{4} \times \frac{4}{5}$. Ans. $\frac{1}{5}$.

10. $\frac{3}{7} \times \frac{5}{8}$. Ans. $\frac{15}{56}$. 15. $\frac{3}{4} \times \frac{8}{9} \times \frac{1}{12}$. Ans. $\frac{1}{9}$.

11. $\frac{2}{3} \times \frac{5}{7}$. Ans. $\frac{10}{21}$. 16. $\frac{6}{7} \times \frac{5}{12} \times \frac{2}{3}$. Ans. $\frac{5}{14}$.

12. $\frac{5}{9} \times \frac{4}{5}$. Ans. $\frac{4}{9}$. 17. $\frac{3}{8} \times \frac{5}{6} \times \frac{4}{9} \times \frac{1}{12}$. Ans. $\frac{5}{36}$.

13. $\frac{6}{17} \times \frac{34}{5}$. Ans. $\frac{12}{5}$. 18. $\frac{1}{5} \times \frac{4}{7} \times \frac{3}{8} \times \frac{2}{5}$. Ans. $\frac{1}{175}$.

19. Multiply $1\frac{1}{4}$ by $2\frac{3}{8}$.

$1\frac{1}{4} = \frac{5}{4}$. $\frac{5}{4} \times \frac{3}{8} = ?$ Reduce both multiplier and multiplicand to improper fractions, and multiply.
 $2\frac{3}{8} = \frac{19}{8}$.

20. $1\frac{1}{8} \times 3\frac{3}{4}$. Ans. $3\frac{3}{8}$. 23. $10\frac{1}{2} \times 4\frac{2}{3}$. Ans. 49.

21. $2\frac{3}{4} \times 6\frac{1}{8}$. Ans. $16\frac{3}{4}$. 24. $16\frac{3}{11} \times 9\frac{7}{8}$. Ans. $151\frac{7}{8}$.

22. $5\frac{1}{7} \times 2\frac{1}{7}$. Ans. $11\frac{1}{49}$. 25. $11\frac{5}{9} \times 11\frac{7}{8}$. Ans. $137\frac{3}{8}$.

To multiply fractions:

Reduce each whole number or mixed number to the form of an improper fraction.

Multiply the numerators together for a new numerator.

Multiply the denominators together for a new denominator.

The new fraction will be the product of the fractions.

REVIEW WORK. — The page of oral work in Partitive Division.

DIVISION OF FRACTIONS.

To Divide a Fraction by a Whole Number.

ORAL WORK.

1. If 2 boys share equally 6 melons, how many melons will each boy have? 6 melons divided by 2 = ?

2. If 2 boys share equally 6 eighths of a melon, how many eighths of a melon will each boy have?

How many are $\frac{6}{8} \div 2$? $\frac{1}{2}$ of $\frac{6}{8} =$?

3. What is $\frac{1}{2}$ of $\frac{8}{10}$? What is $\frac{8}{10} \div 2$?

4. What is $\frac{1}{2} \times \frac{10}{12}$? $\frac{10}{12} \div 2 =$? $\frac{10}{12} \div 5 =$?

5. What is $\frac{1}{8} \times \frac{9}{12}$? $\frac{9}{12} \div 3 =$? $\frac{1}{8} \times \frac{12}{5} =$? $\frac{12}{5} \div 4 =$?

6. What is $\frac{15}{8} \div 3$? $\frac{1}{8} \times \frac{5}{16} =$? $\frac{1}{8} \times \frac{5}{16} =$?

Dividing the numerator of a fraction divides the value of the fraction.

7. If $\frac{1}{2}$ yard of ribbon is cut into 2 equal pieces, what part of the yard of ribbon is each piece? $\frac{1}{2}$ of $\frac{1}{2} =$? $\frac{1}{2} \div 2 =$?

8. If $\frac{1}{2}$ is divided into 3 equal parts, what is each part? $\frac{1}{8} \times \frac{1}{2} =$? $\frac{1}{2} \div 3 =$? $\frac{1}{8} \times \frac{1}{8} =$? $\frac{1}{8} \div 3 =$?

9. If $\frac{1}{4}$ of a bushel of corn is fed to the chickens in 4 days, how much do the chickens get per day? What is $\frac{1}{4} \times \frac{1}{4}$? What is $\frac{1}{4}$ divided by 4? $\frac{1}{4} \div 2 =$?

10. What is $\frac{1}{8} \times \frac{2}{3}$? $\frac{2}{3} \div 3 =$? What is $\frac{1}{8} \times \frac{2}{5}$? $\frac{2}{5} \div 3 =$?

11. What part of a week is $\frac{1}{2}$ of $\frac{3}{7}$ of a week? $\frac{3}{7} \div 2 =$? $\frac{3}{7} \div 3 =$? $\frac{3}{7} \div 4 =$? $\frac{3}{7} \div 5 =$?

12. What is $\frac{1}{2}$ of $\frac{1}{8}$? $\frac{1}{8} \div 2 =$? $\frac{1}{8} \div 3 =$? $\frac{2}{8} \div 3 =$?

13. What is $\frac{1}{2}$ of $\frac{1}{16}$? $\frac{1}{16} \div 2 =$? $\frac{3}{16} \div 2 =$? $\frac{5}{16} \div 2 =$?

Multiplying the denominator of a fraction divides the value of the fraction.

WRITTEN WORK.

1. If 4 barrels of beef weigh $\frac{2}{3}$ of a ton, what is the weight of 1 barrel of beef?

ANALYSIS.

Weight 4 bbl. beef = $\frac{2}{3}$ ton.Weight 1 bbl. beef = $\frac{1}{4}$ of $\frac{2}{3}$ ton.

$$\frac{1}{4} \times \frac{2}{3} \text{ ton} = \frac{1}{6} \text{ ton.}$$

Weight of 1 bbl. beef = $\frac{1}{6}$ ton.

PROCESS.

$$\frac{2}{3} \div 4 = \frac{1}{4} \times \frac{2}{3}.$$

$$\frac{1}{4} \times \frac{2}{3} = \frac{1}{6}.$$

2. In 3 days, a farmer ploughed $\frac{5}{7}$ of a field; what part of the field did he average per day? *Ans.* $\frac{5}{21}$ of the field.

3. If 3 lb. butter cost $\frac{2}{20}$ of a dollar, what does 1 pound cost? *Ans.* $\$ \frac{3}{20}$.

4. A train ran $\frac{1}{10}$ of a mile in 8 seconds; how far did it run per second? *Ans.* $\frac{1}{80}$ mi.

Find the quotients in the following:

5. $\frac{3}{8} \div 3$; $\frac{5}{8} \div 5$; $\frac{7}{8} \div 7$; $\frac{14}{16} \div 7$. *Ans. to each* $\frac{1}{8}$.
 6. $\frac{5}{9} \div 2$; $\frac{5}{2} \div 9$; $\frac{5}{8} \div 3$; $\frac{5}{8} \div 6$. *Ans. to each* $\frac{5}{18}$.
 7. $\frac{2}{3} \div 8$; $\frac{2}{8} \div 4$; $\frac{2}{12} \div 2$; $\frac{2}{8} \div 3$. *Ans. to each* $\frac{1}{12}$.
 8. $\frac{8}{15} \div 4$; $\frac{16}{60} \div 2$; $\frac{16}{45} \div 3$; $\frac{8}{45} \div 4$. *Ans. to each* $\frac{2}{45}$.
 9. Divide $\frac{20}{42}$ by 5; by 6; by 10; by 8; by 20.
 10. Divide $\frac{5}{6}$ by 3; by 17; by 4; by 20; by 5.
 11. Divide $\frac{75}{100}$ by 2; by 3; by 25; by 4; by 5.

To Divide a Mixed Number by a Whole Number.

1. Around a square field is $2\frac{1}{4}$ miles; how long is each side of the field?

$$2\frac{1}{4} \text{ miles} = \frac{9}{4} \text{ mi.} \quad \frac{9}{4} \text{ mi.} \div 4 = ?$$

2. Divide $15\frac{3}{5}$ by 5.

$$\begin{array}{r} 5 \overline{) 15\frac{3}{5}} \\ \underline{3\frac{3}{5}} \end{array}$$

$$15 \div 5 = 3.$$

$$\frac{3}{5} \div 5 = \frac{3}{25}.$$

3. Divide $27\frac{6}{10}$ by 3.

$$\text{Ans. } 9\frac{1}{5}.$$

4. Divide $21\frac{3}{7}$ by 7.

$$\text{Ans. } 3\frac{3}{49}.$$

5. Divide $84\frac{1}{8}$ by 12.

$$\text{Ans. } 7\frac{1}{96}.$$

6. Divide $144\frac{3}{4}$ by 9.*Ans.* $16\frac{1}{2}$.7. Divide $151\frac{1}{5}$ by 5.

$$\begin{array}{r} 5 \overline{)151\frac{1}{5}} \\ 30\cancel{0}\frac{6}{5} \end{array}$$

$$151\frac{1}{5} \div 5 = 30 + 1\frac{1}{5} \div 5.$$

$$1\frac{1}{5} \div 5 = \frac{6}{5} \div 5.$$

$$\frac{6}{5} \div 5 = \frac{6}{25}.$$

8. Divide $301\frac{1}{5}$ by 5.10. Divide $1001\frac{6}{11}$ by 11.9. Divide $253\frac{4}{5}$ by 10.11. Divide $3010\frac{7}{8}$ by 13.12. Divide $297\frac{1}{8}$ by 7.*Ans.* $42\frac{2}{5}\frac{5}{8}$.13. Divide $613\frac{3}{8}$ by 9.*Ans.* $68\frac{5}{7}$.14. Divide $1572\frac{3}{4}$ by 12.*Ans.* $131\frac{1}{8}$.15. Divide $2720\frac{3}{8}$ by 16.*Ans.* $170\frac{1}{8}$.16. Divide $278\frac{4}{5}$ by 4; by 5; by 6; by 7; by 8.*To Divide a Whole Number by a Fraction.***ORAL WORK.**

1. How many half-yards are contained in 1 yard of cloth? How many quarter-yards?

2. How many halves in 1? How many thirds? How many fifths? $1 \div \frac{1}{2} = ?$ $1 \div \frac{1}{3} = ?$ $1 \div \frac{1}{4} = ?$ $1 \div \frac{1}{5} = ?$ 3. How many half-dollars in \$2? In \$3? In \$5? In \$10? $2 \div \frac{1}{2} = ?$ $3 \div \frac{1}{2} = ?$ $5 \div \frac{1}{2} = ?$ $9 \div \frac{1}{2} = ?$ $11 \div \frac{1}{2} = ?$ 4. A farmer put 4 bushels of seed-corn into bags, each holding $\frac{1}{4}$ of a bushel; how many bags? $4 \div \frac{1}{4} = ?$ 5. Mrs. Jones had 12 lb. butter in half-pound cakes; how many cakes of butter? $12 \div \frac{1}{2} = ?$ $12 \div \frac{1}{3} = ?$ 6. A silver dollar weighs $\frac{1}{16}$ of a pound; how many dollars in 3 pounds of silver dollars? $3 \div \frac{1}{16} = ?$ $3 \div \frac{1}{8} = ?$ 7. An inch is $\frac{1}{36}$ of a yard; how many inches are in 4 yards? $4 \div \frac{1}{36} = ?$ $5 \div \frac{1}{36} = ?$ 8. A man gave his boys 4 quarter-dollars, giving each boy $\frac{2}{4}$ of a dollar; how many boys? $\frac{4}{4} \div \frac{2}{4} = ?$ 9. How many tenths are in 6 units? $\frac{60}{10} \div \frac{5}{10} = ?$ 10. How many thirds are in 8 units? $\frac{24}{3} \div \frac{2}{3} = ?$ 11. How many fifths are in 4 units? $\frac{20}{5} \div \frac{2}{5} = ?$ 12. How many sixths are in 6 units? $\frac{36}{6} \div \frac{4}{6} = ?$ 6 units divided by $\frac{3}{8} = ?$ $\frac{48}{8} \div \frac{6}{8} = ?$

WRITTEN WORK.

1. A cook uses $\frac{3}{4}$ lb. of butter per day; in how many days will she use 40 pounds of butter?

ANALYSIS.

(I) If she uses $\frac{3}{4}$ lb. in 1 day, she will use 40 lb. in as many times 1 day as 40 lb., or $\frac{160}{3}$ lb., contains $\frac{3}{4}$ lb.

$$\frac{160}{3} \text{ lb.} \div \frac{3}{4} \text{ lb.} = 53\frac{1}{3} \text{ times.}$$

$$53\frac{1}{3} \times 1 \text{ day} = 53\frac{1}{3} \text{ days.}$$

(II) $\frac{3}{4}$ lb. = butter used in 1 day.
 $\frac{1}{4}$ lb. = butter used in $\frac{1}{3}$ day.
 1 lb. = butter used in $\frac{4}{3}$ days.
 40 lb. = butter used in $\frac{160}{3}$ days.
 $\frac{160}{3}$ days = $53\frac{1}{3}$ days.

PROCESS.

$$40 \div \frac{3}{4} = \frac{160}{3} \div \frac{3}{4}.$$

$$\frac{160}{3} \div \frac{3}{4} = 160 \div 3.$$

$$160 \div 3 = 53\frac{1}{3}.$$

2. A farmer made $\frac{2}{3}$ of a bale of cotton per acre on a field which produced 29 B/C; how many acres were in the field?

Ans. $43\frac{1}{2}$ acres.

3. If $\frac{7}{8}$ of a dollar will buy a bushel of wheat, how many bushels can be bought for 50 dollars?

Ans. $57\frac{1}{7}$ bu.

4. A bushel of oats weighs $\frac{4}{5}$ of the weight of a bushel of corn; how many bushels of oats will weigh as much as 100 bushels of corn?

Ans. 175 bu. oats.

Find the quotients in the following :

5. $100 \div \frac{2}{3}$; $50 \div \frac{3}{4}$; $60 \div \frac{9}{10}$.

Ans. to each $66\frac{2}{3}$.

6. $30 \div \frac{4}{5}$; $20 \div \frac{5}{15}$; $18 \div \frac{1}{2}$.

Ans. to each $37\frac{1}{2}$.

7. $75 \div \frac{4}{7}$; $56 \div \frac{1}{2}$; $70 \div \frac{4}{5}$.

Ans. to each $87\frac{1}{2}$.

8. $42 \div \frac{4}{5}$; $28 \div \frac{8}{15}$; $45 \div \frac{4}{7}$.

Ans. to each $52\frac{1}{2}$.

9. $25 \div \frac{3}{10}$; $20 \div \frac{6}{25}$; $5 \div \frac{5}{10}$.

Ans. to each $83\frac{1}{3}$.

10. $15 \div \frac{9}{10}$; $10 \div \frac{3}{5}$; $6 \div \frac{2}{5}$.

Ans. to each $16\frac{2}{3}$.

11. $15 \div \frac{4}{5}$; $6 \div \frac{8}{5}$; $5 \div \frac{4}{5}$.

Ans. to each $18\frac{3}{4}$.

12. $21 \div \frac{3}{8}$; $31 \div \frac{5}{8}$; $41 \div \frac{7}{8}$.

Ans. ———.

13. $36 \div \frac{4}{9}$; $46 \div \frac{5}{9}$; $56 \div \frac{7}{8}$.

Ans. ———.

14. $72 \div \frac{7}{8}$; $72 \div \frac{7}{16}$; $72 \div \frac{9}{16}$.

Ans. ———.

To Divide a Fraction by a Fraction.

WRITTEN WORK.

1. At $\frac{2}{5}$ of a dollar per gallon, how much syrup can be bought for $\frac{3}{4}$ of a dollar?

ANALYSIS.

$\frac{2}{5}$ of a dollar = $\frac{8}{20}$ of a dollar.

$\frac{3}{4}$ of a dollar = $\frac{15}{20}$ of a dollar.

$\frac{8}{20}$ is the cost of 1 gal. syrup.

PROCESS.

$$\frac{3}{4} \div \frac{2}{5} = \frac{15}{20} \div \frac{8}{20}.$$

$$\frac{15}{20} \div \frac{8}{20} = 15 \div 8.$$

$$15 \div 8 = 1\frac{7}{8}.$$

For $\$1\frac{7}{8}$, as many times 1 gallon of syrup can be bought as $\frac{15}{8}$ contains $\$ \frac{8}{20}$, which is $1\frac{7}{8}$ times.

$$1\frac{7}{8} \times 1 \text{ gal.} = 1\frac{7}{8} \text{ gal.}$$

2. How many boxes, each to contain $\frac{1}{8}$ bushel, can be filled from a sack holding $\frac{3}{4}$ bu. meal? *Ans.* 6 boxes.

3. At $\frac{3}{10}$ of a dollar per yard, how many yards of flannel can be bought for $\frac{3}{4}$ of a dollar? *Ans.* $2\frac{1}{2}$ yd.

4. If $\frac{7}{8}$ of a bushel of wheat will sow 1 acre, what part of the acre will $\frac{3}{4}$ of a bushel sow? *Ans.* $\frac{9}{4}$ A.

Find the quotients in the following:

5. $\frac{5}{8} \div \frac{5}{6}$; $\frac{1}{2} \div \frac{2}{3}$; $\frac{3}{4} \div \frac{4}{7}$; $\frac{1}{2} \div \frac{5}{8}$. *Ans. to each* $\frac{3}{2}$.

6. $\frac{1}{2} \div \frac{3}{4}$; $\frac{5}{12} \div \frac{2}{3}$; $\frac{1}{2} \div \frac{5}{8}$; $\frac{5}{8} \div \frac{2}{3}$. *Ans. to each* $\frac{5}{6}$.

7. $\frac{3}{8} \div \frac{3}{4}$; $\frac{1}{10} \div \frac{4}{5}$; $\frac{3}{4} \div \frac{5}{7}$; $\frac{3}{8} \div \frac{5}{8}$. *Ans. to each* $\frac{7}{8}$.

8. $\frac{8}{21} \div \frac{5}{7}$; $\frac{1}{18} \div \frac{7}{8}$; $\frac{5}{27} \div \frac{5}{12}$; $\frac{1}{12} \div \frac{3}{16}$. *Ans. to each* $\frac{4}{9}$.

9. $\frac{1}{8} \div \frac{3}{10}$; $\frac{1}{8} \div \frac{4}{5}$; $\frac{2}{9} \div \frac{1}{15}$; $\frac{5}{82} \div \frac{3}{8}$. *Ans. to each* $\frac{5}{12}$.

10. $\frac{3}{4} \div \frac{4}{5}$; $\frac{3}{20} \div \frac{4}{25}$; $\frac{3}{2} \div \frac{5}{8}$; $\frac{1}{12} \div \frac{4}{5}$. *Ans. to each* $\frac{1}{6}$.

11. $\frac{1}{2} \div \frac{6}{7}$; $\frac{1}{2} \div \frac{3}{8}$; $\frac{1}{16} \div \frac{3}{22}$; $\frac{1}{4} \div \frac{6}{11}$. *Ans. to each* $\frac{1}{24}$.

12. $\frac{1}{10} \div \frac{4}{25}$; $\frac{1}{12} \div \frac{5}{15}$; $\frac{1}{8} \div \frac{4}{5}$; $\frac{3}{8} \div \frac{3}{5}$. *Ans. to each* $\frac{5}{32}$.

13. $\frac{1}{18} \div \frac{2}{3}$; $\frac{1}{2} \div \frac{3}{4}$; $\frac{1}{2} \div \frac{3}{7}$; $\frac{3}{2} \div \frac{5}{8}$. *Ans. to each* $1\frac{1}{4}$.

14. $6\frac{1}{2} \div 2\frac{1}{2}$; $3\frac{1}{2} \div 1\frac{1}{4}$; $8\frac{1}{2} \div 3\frac{1}{2}$; $15\frac{5}{8} \div 6\frac{1}{2}$. *Ans. to each* $2\frac{1}{2}$.

15. $11\frac{1}{2} \div 3\frac{1}{2}$; $8\frac{1}{2} \div 2\frac{1}{2}$; $4\frac{1}{6} \div 1\frac{1}{4}$; $41\frac{2}{3} \div 12\frac{1}{2}$. *Ans. to each* $3\frac{1}{2}$.

16. $14\frac{2}{3} \div 1\frac{1}{3}$; $22\frac{1}{2} \div 1\frac{2}{3}$; $14\frac{1}{3} \div 1\frac{1}{15}$; $21\frac{2}{3} \div 1\frac{1}{7}$. *Ans. to each* $12\frac{1}{2}$.

17. $40\frac{5}{8} \div 2\frac{1}{8}$; $43\frac{3}{4} \div 2\frac{1}{8}$; $38\frac{3}{4} \div 2\frac{1}{15}$; $24\frac{3}{8} \div 1\frac{3}{10}$. *Ans. to each* $18\frac{3}{4}$.

To divide fractions:

Reduce the dividend and divisor to fractions having the least common denominator.

Divide the numerator of the dividend by the numerator of the divisor.

REVIEW.

1. Melons are planted on $\frac{1}{4}$ of a garden containing $\frac{4}{5}$ of an acre; what part of an acre is planted in melons? *Ans.* $\frac{1}{5}$ A.

2. A man spent $\$6\frac{3}{4}$ for stationery, and $\$5\frac{9}{10}$ for books; find the sum. *Ans.* $\$12\frac{1}{5}$.

3. A minuend is $170\frac{1}{4}$; the subtrahend is $69\frac{3}{8}$; find the remainder. *Ans.* $100\frac{7}{8}$.

4. A man's weekly salary is $\$16\frac{1}{2}$; what does he receive per day? *Ans.* $\$2\frac{3}{4}$.

5. A railroad company's force laid 100 miles of track in $4\frac{1}{2}$ days; find the average number of miles of track laid per day. *Ans.* $22\frac{2}{3}$ mi.

6. The product of two factors is $\frac{3}{16}$; one of the factors is $\frac{2}{8}$; what is the other factor? *Ans.* $\frac{9}{82}$.

7. Of a field of wheat, $\frac{2}{3}$ is sowed in drills, and 20 acres are sowed broadcast; how many acres are sowed in drills? *Ans.* 40 acres.

8. A rice-planter had a ditch dug in three days; the first day $\frac{1}{3}$ of it was dug, the second day $\frac{2}{3}$ of it, and the third day 56 yards; find the length of the ditch. *Ans.* 126 yd.

9. A farmer sold $\frac{3}{4}$ of his corn, and kept the remainder, 564 bushels, for his own use; how many bushels of corn did he sell? *Ans.* 423 bu.

10. In how many days can a man reap a field of grain, if he reap $\frac{3}{8}$ of the field per day? *Ans.* $10\frac{2}{3}$ days.

11. On a ship the officers and crew, and other employes, compose $\frac{1}{2}$ of the total number of persons; $\frac{5}{8}$ of the number are cabin passengers, and all the others, 174 persons, are emigrants in the steerage; how many persons are on the ship? *Ans.* 288 persons.

12. The multiplicand is $32\frac{3}{4}$ bushels of corn; the multiplier is $21\frac{1}{2}$; what is the product? *Ans.* $704\frac{1}{4}$ bu. corn.

13. The dividend is $1488\frac{1}{2}$ bu. wheat; the quotient is $18\frac{1}{2}$ bu. wheat; find the divisor. *Ans.* $80\frac{1}{7}$.

DECIMAL FRACTIONS.

TABLE OF U. S. MONEY.

10 mills = 1 cent (\$.01).

10 cents = 1 dime (\$.10).

10 dimes = 1 dollar (\$1).

ORAL WORK.

1. How many dimes make a dollar ?
2. How many cents make a dime ?
3. What part of a dollar is a dime ?
4. What part of a dime is a cent ?
What part of a cent is a mill ?
5. What is one-tenth of one dollar ?
6. What is one-tenth of a dime ?
7. What is one-tenth of one-tenth of a dollar ?
8. What is one-tenth of one-tenth of a unit ?
9. What fraction of a dollar is a dime ?
What fraction of a cent is a mill ?
10. What fraction of a dollar is a cent ? 3 cents ?
11. What fraction of a dollar is 7 cents ? 9¢ ?
12. What fraction of \$1 is \$.15 ? \$.17 ? \$.19 ?
13. What part of \$1.00 is \$.13 ? \$.11 ? \$.09 ? \$.01 ?
14. In \$.11 how many tenths and hundredths of \$1 ?
15. In \$.22 how many tenths and hundredths of \$1 ?
16. In .22 how many tenths and hundredths of a unit ?
17. In \$1.02 how many dollars ? how many cents ?
18. In 1.02 how many units ? how many hundredths ?
19. In \$1.20 how many dollars ? how many dimes ?
20. In 1.2 how many units ? how many tenths ?
21. In 1.22 how many units ? how many tenths ? how many hundredths ?

DEFINITIONS.

A **Decimal Fraction** is one whose implied denominator is 10, or some number each of whose smallest equal factors is 10; as 100, 1000, etc.

Decimal fractions, as well as whole numbers, are written in Arabic or Decimal notation.

In writing a decimal fraction, only the numerator is expressed. If the expression for the numerator occupies one place to the right of the decimal point (\cdot), the denominator 10 is implied; if two places, the denominator 100 is implied; if three places, the denominator 1000, and so on.

In the number 123.456

The position of the	1	implies the multiplier 100;
The position of the	2	implies the multiplier 10;
The position of the	3	implies the multiplier 1;
The position of the	4	implies the multiplier $\frac{1}{10}$;
The position of the	5	implies the multiplier $\frac{1}{100}$;
The position of the	6	implies the multiplier $\frac{1}{1000}$.

In the number 222.222, each 2 is 10 times as great as the 2 to its right; the 2 to the left of the decimal point is 10 times the 2 to the right of the decimal point.

The number 222.222, which is read two hundred twenty-two and two hundred twenty-two thousandths, is expressed decimally throughout; the 222 are units; the 222 thousandths are less than a unit.

Numbers decrease by tens from left to right even past the decimal point.

WRITTEN WORK.

Express decimally :

1. $1\frac{1}{10}$; $\frac{2}{10}$; $1\frac{3}{10}$; $\frac{4}{10}$; $1\frac{5}{10}$; $\frac{6}{10}$; $1\frac{7}{10}$; $\frac{8}{10}$; $1\frac{9}{10}$; $1\frac{10}{10}$.
2. $1\frac{10}{100}$; $1\frac{9}{100}$; $\frac{99}{100}$; $1\frac{999}{1000}$; $1\frac{990}{1000}$; $\frac{95}{1000}$; $1\frac{9}{1000}$.
3. $10\frac{9}{100}$; $\frac{9}{1000}$; $10\frac{9}{10}$; $10\frac{5}{100}$; $\frac{15}{1000}$; $10\frac{85}{1000}$.
4. Ten and four hundred fifteen thousandths.
5. Ten and four hundred five thousandths.

The fourth decimal order is called ten-thousandths.

Express decimally :

6. $101\frac{101}{10000}$; $101\frac{1}{100}$; $101\frac{1}{10}$; $101\frac{11}{100}$; $101\frac{111}{1000}$; $101\frac{1111}{10000}$.

7. $101\frac{1}{10}$; $101\frac{1}{100}$; $101\frac{1}{1000}$; $101\frac{11}{10000}$; $101\frac{111}{100000}$; $101\frac{1111}{1000000}$.

8. Eleven and eleven ten-thousandths.

9. Eleven and one hundred one ten-thousandths.

The fifth decimal order is called hundred-thousandths.

10. $101\frac{101}{100000}$; $101\frac{1101}{100000}$; $101\frac{11101}{1000000}$; $101\frac{1}{1000000}$.

The sixth decimal order is called millionths.

11. $22\frac{1011}{1000000}$; $33\frac{10111}{10000000}$; $44\frac{101111}{100000000}$; $55\frac{111101}{1000000000}$.

Express as common fractions the following decimal fractions :

12.	13.	14.	15.	16.	17.
.12	.01	.001	.0001	.00001	.123456
.13	.05	.002	.0009	.00009	.12345
.3	.06	.009	.001	.0001	.1234
.27	.07	.01	.009	.0009	.123
.18	.08	.09	.01	.001	.12
.1	.09	.1	.1	.009	.1
.15	.1	.015	.1657	.01	.1007
.32	.11	.15	.2003	.09	.19001

ADDITION OF DECIMALS.

WRITTEN WORK.

1. A man spent \$4.15 for books, \$3.75 for a lamp, and \$6.25 for a chair; find the sum. *Ans.* \$14.15.
2. Find the sum of \$15.95, \$16.35, and \$18.72. *Ans.* \$51.02.
3. Add 3.15, 4.17, and 6.19. *Ans.* 13.51.
4. Add 4.119, 6.218, and 7.307. *Ans.* 17.644.
5. Add 7.001, 18.15, and 3.172. *Ans.* 28.323.
6. Add 7.09, 19.651, and 29.6051. *Ans.* 56.3461.
7. Add 8.159, 191.06, and 43.006. *Ans.* 242.225.
8. Add 103.1, 27.009, and 167.13. *Ans.* 297.239.
9. Find the sum of 8 tenths, 9 hundredths, 89 thousandths, and 3 ten-thousandths. *Ans.* .9793.

SUBTRACTION OF DECIMALS.

WRITTEN WORK.

1. A man had \$50.00, and spent \$10.25; how much did he then have? *Ans.* \$39.75.
2. The receipts of a railroad company in one month amounted to \$2 134 349.73; the expenses for the month amounted to \$1 800 949.95; what was the net gain? *Ans.* \$333 399.78.
3. Subtract 18 hundredths from $1.8 = 1.80$
1 and 8 tenths. *Ans.* 1.62. .18
4. Subtract 18 thousandths from 18 hundredths. *Ans.* .162.
5. Subtract 18 ten-thousandths from 18 thousandths.
Ans. .0162.
6. Subtract, decimally, $1\frac{3}{10}$ from $2\frac{3}{100}$. *Ans.* .73.
7. Subtract, decimally, $2\frac{3}{100}$ from $3\frac{3}{1000}$. *Ans.* .973.
8. Subtract, decimally, $2\frac{3}{10}$ from $3\frac{3}{1000}$. *Ans.* .703.
9. Subtract, decimally, $2\frac{3}{10}$ from $3\frac{3}{10000}$. *Ans.* .7003.
10. Subtract 18 and three hundred four thousandths from 19 and seven tenths. *Ans.* 1.396.

REVIEW WORK. — Problems 2, 3, 5, and 12 in the Review-page following Division of Common Fractions.

MULTIPLICATION OF DECIMALS.

WRITTEN WORK.

1. A man earned \$12.50 per week; how much in 10 weeks?
Ans. \$125.00.
- Each removal of the decimal point in a number one place to the right multiplies the number by 10.*
2. A bale of cotton was sold for \$36.08. Find the value of 100 such bales. *Ans.* \$3 608.
 3. Find the value of 1 000 bushels of corn, @ \$.60 per bushel. *Ans.* \$600.
 4. Bought 18 lb. beef, @ \$.15 per lb., and 25 lb. mutton, @ \$.16 per lb. Paid with a \$5-note, and the balance in silver; how much silver? *Ans.* \$1.70.

BILLS.

1. *Nashville, Tenn., July 1, 1892.*

Mr. J. W. Jones,

Bought of F. R. RIVERS & CO.

12	lb. Rice @ \$.07		×	×		
133	" A. Sugar @ .05		×	×	×	
40	" Rio Coffee @ .25		×	×	×	
						17 49

Said,

F. R. Rivers & Co.

Copy, rule as a bill-head, find the amount, and receipt each bill below :

2. *LOUISVILLE, KY., Apr. 29, 1892.*

Mrs. R. E. WILSON,

Bought of H. E. & J. W. JOHNSON,

14 yd. prints @ \$.06
 2½ doz. hdkf. @ 2.00
 18 yd. drilling @ .09
 22 yd. sheeting @ .25

Received payment,

3. *LITTLE ROCK, ARK., Oct. 9, 1891.*

JAS. MITCHELL,

Bought of WILSON & WEBB,

12 quires foolscap @ \$.25
 12 " legal cap @ .45
 4 gross Gillott pens @ 1.25
 12 doz. Faber pencils @ .60
 1 quart ink for .50

Make out receipted bills for the following articles, giving the names of buyers and sellers, dates of sales, etc., at pleasure:

4. Cotton-seed meal, 4 tons, at \$21 per ton; corn, 30 bu., at \$.60 per bushel; oats, 26 bu., @ \$.38 per bushel.

Total, \$111.88.

5. Coal: 10 tons Anthracite, @ \$9.50; 18 tons McAlister, @ \$6.50.

Total, \$212.

6. Bacon: 76 lb. short clear sides, @ \$.09; 33 lb. short rib sides, @ \$.08; 98 lb. shoulders, @ \$.06.

Total, \$15.36.

7. Vegetables: 14 bbl. potatoes, @ \$2.10; 3 bbl. onions, @ \$4.25; cow-peas, 16 bu., @ \$1.25; tomatoes, 4 bu., @ \$1.10; sweet potatoes, 12 bu., @ \$1.40.

Total, \$83.35.

Decimals Multiplied by Decimals.

- | | |
|------------------------------------------------|----------------------------------------------------------|
| 1. Multiply $\frac{1}{10}$ by $\frac{1}{10}$. | $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$. |
| Multiply $\frac{1}{10}$ by $\frac{1}{100}$. | $\frac{1}{100} \times \frac{1}{10} = \frac{1}{1000}$. |
| Multiply $\frac{1}{10}$ by $\frac{1}{1000}$. | $\frac{1}{1000} \times \frac{1}{10} = \frac{1}{10000}$. |

The denominator of the product contains as many noughts as there are noughts in the denominators of the factors of the product.

- | | |
|-----------------------|----------------------------|
| 2. Multiply .1 by .1. | $.1 \times .1 = .01$. |
| Multiply .1 by .01. | $.01 \times .1 = .001$. |
| Multiply .1 by .001. | $.001 \times .1 = .0001$. |

The product contains as many decimal places as there are decimal places in its factors.

- | | |
|---------------------------------|--------------------------|
| 3. Multiply 1.25 by 2.5. | <i>Ans. 3.125.</i> |
| 4. Multiply 12.5 by 2.5. | <i>Ans. 31.25.</i> |
| 5. Multiply 12.55 by 2.5. | <i>Ans. 31.375.</i> |
| 6. Multiply 125.5 by 2.5. | <i>Ans. 313.75.</i> |
| 7. Multiply \$1.255 by 2.5. | <i>Ans. \$3.1375.</i> |
| 8. Multiply \$1.255 by .25. | <i>Ans. \$.31375.</i> |
| 9. Multiply .1255 by .25. | <i>Ans. .031375.</i> |
| 10. Multiply 17.56 by .19. | <i>Ans. 3.3364.</i> |
| 11. Multiply 300.1 by 99.09. | <i>Ans. 29736.909.</i> |
| 12. Multiply 166.001 by 3.0795. | <i>Ans. 511.2000795.</i> |

To multiply decimals :

Multiply as in whole numbers ; point off in the product as many decimal places as there are decimal places in both factors, prefixing noughts when necessary.

DIVISION OF DECIMALS.

WRITTEN WORK.

1. A farmer received \$321.50 for 10 *B/C* ; what was the average value ? *Ans.* \$32.15.

Each removal of the decimal point one place to the left divides a number by 10.

2. A merchant bought 100 bushels of oats for \$33.00 ; find the price per bushel. *Ans.* \$.33.

3. A boat made 114.75 miles in 9 hours ; find her average speed per hour. *Ans.* 12.75 mi.

4. A ticket from D. to H. costs \$7.95 ; the distance is 265 miles ; find the rate. *Ans.* \$.03 per mile.

5. A ticket from D. to G. costs \$9.45, @ \$.03 per mile ; find the distance. *Ans.* 315 miles.

6. How many times does 12.45 contain .03 ? *Ans.* 415 times.

7. How many times does 12.45 contain .3 ? *Ans.* 41.5 times.

8. How many times does 12.45 contain 3 ? *Ans.* 4.15 times.

9. How many times does \$12 contain 3¢ ?

To the dividend annex as many noughts in decimal places as are required to equal the number of decimal places of the divisor.
$$\begin{array}{r} .03 \overline{)12.00} \\ \underline{400} \end{array}$$

10. How many times does 4.2 contain .006 ? *Ans.* 700 times.

11. Divide 16.8 by 2.1. *Ans.* 8.

12. Divide 168 by 2.1. *Ans.* 80.

13. Divide 40.32 by 8. *Ans.* —.

14. Divide 39.12 by .03. *Ans.* 1304.

15. Divide 20.16 by .42. *Ans.* —.

16. Divide 5.04 by .21. *Ans.* —.

17. Multiply 5.45 by .016, and prove the work by dividing the product by the multiplicand.

$$\begin{array}{r}
 5.45 \\
 \times .016 \\
 \hline
 3270 \\
 545 \\
 \hline
 .08720
 \end{array}
 \qquad
 \begin{array}{r}
 5.45 \times .08720 \div .016 \\
 \hline
 545 \\
 \hline
 3270 \\
 \hline
 3270
 \end{array}$$

To divide decimals by decimals :

Divide as in whole numbers.

Point off in the quotient as many decimal places as the number of decimal places in the dividend exceeds the number of decimal places in the divisor, prefixing noughts when necessary.

18. Divide the product of 10.90 and .32 by the product of 5.45 and 2. Ans. .32.

19. Divide the product of 6.16 and .16 by the product of 3.08 and 20. Ans. .016.

20. Divide the product of 12.32 and .32 by the product of 3.08 and 400. Ans. —.

21. Divide 17.28 by 1.2. Ans. 14.4.

22. Prove No. 21 by multiplication.

23. Multiply 19.9 by .03. Ans. —.

24. Prove No. 23 by division.

25. Divide the product of 1.856 and 7.2 by the product of 32 and .9. Ans. —.

Reduction of Common Fractions to Decimals.

26. Reduce $\frac{1}{8}$ to a decimal fraction.

$$\frac{1}{8} = 1 \div 8. \qquad \begin{array}{r} 8 \overline{)1.000} \\ \underline{.125} \end{array}$$

27. Reduce $\frac{3}{8}$ to a decimal fraction.

28. Reduce $\frac{5}{8}$ to a decimal fraction. Ans. .83 $\frac{1}{2}$.

29. Reduce $\frac{7}{8}$ to a decimal fraction.

30. Reduce $\frac{1}{2}$ to a decimal fraction.

31. Reduce $\frac{3}{4}$ to a decimal fraction.

32. What decimal fraction equals $\frac{3}{4} \times \frac{3}{8}$? Ans. .28125.

33. What decimal fraction equals $\frac{3}{4} - \frac{3}{8}$? Ans. .375.

REVIEW.

1. Find the value of 10 *B/C* averaging 475 lb. @ \$.08 $\frac{1}{2}$ per lb. *Ans.* \$403.75.

2. A farmer made 34 bushels of corn to the acre on a field of 21 $\frac{1}{2}$ acres; find the entire yield. *Ans.* —.

3. A train runs 22 $\frac{1}{2}$ miles per hour between two towns 265 miles apart; how many hours are required to make the whole distance? *Ans.* —.

4. A cotton-buyer paid \$3341.25 for 90 *B/C*, classed Strict Ordinary, averaging 450 lb. to the bale; at how much per pound was the cotton bought? *Ans.* \$.08 $\frac{1}{4}$.

5. If $\frac{4}{5}$ of a bushel of corn weighs as much as 1 bushel of oats, what part of a bushel of oats does $\frac{3}{8}$ of a bushel of corn equal in weight? *Ans.* $\frac{2}{3}\frac{1}{2}$ bu. oats.

6. If $\frac{5}{7}$ of a bushel of corn weighs as much as 1 bushel of meal, what part of a bushel of meal does $\frac{5}{8}$ of a bushel of corn equal in weight? *Ans.* $\frac{3}{4}\frac{5}{8}$ bu. meal.

7. What part of a dollar is \$.65? *Ans.* $\frac{1}{2}\frac{1}{2}\frac{1}{2}$.

8. A farmer had 397 acres in corn, cotton, and oats; he had $\frac{1}{3}$ of it in corn, and $\frac{1}{2}$ of it in cotton; how many acres did he have in oats? *Ans.* 66 $\frac{1}{2}$ A.

9. An acre of rich land yielded 1350 lb. seed-cotton; upon being ginned $\frac{1}{3}$ of it was lint, and was packed into a bale; what was the weight of the bale, the bagging and ties weighing 24 lb.? *Ans.* 474 lb.

10. Mr. Jones rented to Mr. Brown 75 acres, to be planted half in corn and half in cotton; the corn-crop was 32 $\frac{1}{2}$ bushels per acre, and the crop of cotton 576 lb. seed-cotton per acre. What was the entire corn-crop? *Ans.* 1218 $\frac{3}{4}$ bu.

What was the entire crop of seed-cotton? *Ans.* 21600 lb.

11. The rent paid by Mr. Brown was $\frac{1}{3}$ of the corn and $\frac{1}{4}$ of the cotton; how many pounds of seed-cotton did he pay? How many bushels of corn did he pay? *Ans.* 406 $\frac{1}{4}$ bu.

12. Of the seed-cotton $\frac{1}{3}$ was lint; how many pounds of lint-cotton did Mr. Jones receive for rent? *Ans.* —.

How many pounds in Mr. Brown's share? *Ans.* —.

13. The lint-cotton was packed into 16 bales; what was the average weight of the lint-cotton to the bale?

14. What was the weight of the average bale, 24 lb. of bagging and ties being used on each? *Ans.* 474 lb.

15. Mr. Brown received \$82.95 for cotton sold @ \$.08 $\frac{1}{2}$; find the number of pounds sold. *Ans.* 948 lb.

16. Make a receipted bill for the sale of 150 lb. bacon @ \$.08 $\frac{1}{2}$; 2 bbl. flour @ \$5.75; 96 lb. granulated sugar @ \$.05 $\frac{1}{2}$; 10 gal. syrup @ \$.55; and 1 sack of salt for \$.90.

Amount of bill, \$36.17.

17. A train leaves H. at 5 A.M. and reaches N., 362 miles away, at 6 P.M. of the same day. Find the average distance made per hour. *Ans.* 27 $\frac{1}{2}$ miles.

18. Corn in the ear weighs 70 lb. to the bushel; shelled corn weighs $\frac{2}{3}$ as much. A farmer wishes to send 900 lb. shelled corn to mill; how many bushels of ear-corn must be shelled? *Ans.* 12 $\frac{1}{2}$ bu.

19. If $\frac{4}{5}$ of a bushel of ear-corn weighs as much as a bushel of shelled corn, what part of a bushel of shelled corn does $\frac{1}{2}$ of a bushel of ear-corn equal in weight?

Ans. $\frac{5}{8}$ bu. shelled corn.

20. If John can plough 1 acre of land in $\frac{2}{3}$ of a day, what part of an acre can he plough in $\frac{3}{4}$ of a day? *Ans.* —.

21. In $\frac{3}{4}$ of a mile there are 1320 yards; how many yards are in $\frac{7}{8}$ of a mile? *Ans.* —.

22. In a school district $\frac{3}{8}$ of the pupils are in the first grade, $\frac{1}{8}$ of the pupils in the second grade, and in the other grades there are 140 pupils; how many pupils are in the district?

Ans. 480 pupils.

23. During the summer months of 1840 an emigrant train moved westward 1350 miles. At the end of June, $\frac{2}{5}$ of the journey had been made; at the end of July, $\frac{2}{3}$ of the journey had been made. What part of the whole journey was made during July?

Ans. $\frac{2}{3}$ of it.

How many miles were made during August? *Ans.* 510 mi.

24. In four days a river rose 13 feet; Monday it rose $1\frac{1}{4}$ feet, Tuesday 3.1 feet, and Wednesday 4.6 feet; how many feet did it rise on Thursday? *Ans.* $4\frac{1}{10}$ ft.

25. The loss by a great fire was \$1 512 000; the amount of insurance paid was \$1 008 000; what part of the loss was paid? *Ans.* $\frac{2}{3}$ of the loss.

26. In 1856 there were three candidates for the Presidency; of the electoral votes Fillmore received $\frac{1}{7}$; Fremont received 114 votes, and Buchanan received 174. Find Buchanan's majority over both the other candidates. *Ans.* 52 votes.

27. A rainfall of $\frac{3}{4}$ of an inch gives to the acre 20 365 $\frac{1}{2}$ U. S. gallons of water; how many U. S. gallons does a rainfall of 1 inch give to the acre? *Ans.* 27 154 $\frac{1}{2}$ U. S. gal.

28. If a rainfall of $\frac{3}{4}$ of an inch will give to the acre 16 968 English gallons of water, how many English gallons will a rainfall of $\frac{3}{8}$ of an inch give to the acre? *Ans.* 21 917 E. gal.

29. Find the decimal fraction that is equal to the difference of the sums of $\frac{3}{4} + \frac{1}{8}$ and $\frac{5}{8} + \frac{3}{8}$. *Ans.* .15625.

30. One-fourth of 2 828 equals $\frac{1}{5}$ of what number? *Ans.* 3 535.

31. How many pounds of sugar must a grocer sell in order to gain \$ 5.25, if he gains $\frac{1}{2}$ cent on every pound? *Ans.* 1 050 lb.

32. A farmer made 37 $\frac{1}{2}$ bushels of oats per acre, and his whole crop was 956 $\frac{1}{4}$ bushels; how many acres did he sow in oats? *Ans.* 25 $\frac{1}{2}$ A.

33. The quotient is $\frac{2}{3}$; the dividend is $\frac{3}{4}$; what is the divisor? *Ans.* $3\frac{3}{8}$.

34. The remainder is $1\frac{1}{3}$; the subtrahend is $2\frac{3}{4}$; what is the minuend? *Ans.* $4\frac{1}{12}$.

35. The remainder is $16\frac{2}{3}$; the minuend is $17\frac{2}{3}$; what is the subtrahend? *Ans.* $\frac{4}{3}$.

36. The product of two numbers is $\frac{3}{8}$; the multiplicand is $12\frac{1}{2}$; what decimal fraction is equal to the multiplier? *Ans.* .03.

COMPOUND NUMBERS.

MEASURES.

ORAL WORK.

1. By what measure is corn sold ? Molasses ? Sugar ?
2. By what unit is farm-land sold ? Lace ?
3. Name two measures used by the grocer.
4. Name three units of measure for reckoning time.
5. How many pecks are in a bushel ?
6. How many pecks in 2 bushels and 3 pecks ?
7. How many bushels are in 16 pecks ?
8. How many feet are in a yard ?
9. How many feet are in 3 yards and 2 feet ?
10. How many yards are in 18 feet ?
11. How many inches are in a foot ?
12. How many inches are in a yard ?
13. How many inches are in $\frac{3}{4}$ of a yard ?
14. A farmer sold 6 bushels and 1 peck of corn to one man and 3 bushels and 3 pecks to another; how many bushels did he sell to both ?
15. How much more than the second man did the first man buy ?
16. A dairyman sold to each of four customers 2 gallons and 2 quarts of milk; how many gallons did he sell to the four ?
17. A rope was cut into four pieces each 13 feet 3 inches in length; how long was the rope at first ?
18. A farmer gave his horses 3 bushels and 2 pecks of corn in 2 days; how much did he give them per day ?
19. What is $\frac{1}{2}$ of 4 yards 2 feet and 6 inches ?

Quantity can be estimated or measured.

Measures are units of *Quantity*.

DRY MEASURES.

The dry measures are pints, quarts, pecks, and bushels; they are used in estimating quantities of grain, fruit, and many other dry products.

Tables of Dry Measures.

2 pt. = 1 qt.	1 qt. = 2 pt.
8 qt. = 1 pk.	1 pk. = 8 qt. = 16 pt.
4 pk. = 1 bu.	1 bu. = 4 pk. = 32 qt. = 64 pt.

WRITTEN WORK.

1. Reduce to pints 5 bu. 1 pk. 3 qt. 1 pt.

ANALYSIS WITH PROCESS.

	bu.	⁴ pk.	⁸ qt.	² pt.
	5	1	3	1
1 bu. = 4 pk.		4		
5 bu. = 5×4 pk. = 20 pk.		20		
		1		
20 pk. + 1 pk. = 21 pk.		21		
		8		
1 pk. = 8 qt.		168		
21 pk. = 21×8 qt. = 168 qt.		3		
		171		
168 qt. + 3 qt. = 171 qt.		2		
		342		
1 qt. = 2 pt.		1		
171 qt. = 171×2 pt. = 342 pt.		343		
342 pt. + 1 pt. = 343 pt.				

Observe that in the process the multipliers are used as multipliers.

In 5 bu. 1 pk. 3 qt. and 1 pt. there are 343 pints.

- | | |
|-----------------------------------------|---------------------|
| 2. Reduce 17 bu. 3 pk. 7 qt. to quarts. | <i>Ans.</i> 575 qt. |
| 3. Reduce 3 pk. 5 qt. 1 pt. to pints. | <i>Ans.</i> 59 pt. |
| 4. Reduce 6 bu. 2 pk. to pecks. | <i>Ans.</i> 26 pk. |

5. Reduce 172 bu. 3 qt. to pints.

PROCESSES.						
bu.	pk.	qt.	pt.	bu.	qt.	pt.
172	0	3	0	172	3	0
4				32		
688	pk.			344		
8				516		
5504	qt.			5504	qt.	
3	qt.			3	qt.	
5507	qt.			5507	qt.	
2				2		
11014	pt.			11014	pt.	

6. What would be the cost of 3 bu. 2 pk. peanuts at \$.03 per pint? *Ans.* \$6.72.

7. A dealer bought $17\frac{1}{2}$ bu. pecans @ \$1.50 per bushel and retailed them @ \$.05 per pint; how much did he gain? *Ans.* \$29.75.

8. A huckster bought 5 bu. onions @ \$1.25 per bushel and sold them @ \$.08 per quart; how much did he gain? *Ans.* \$6.55.

9. How many days will 32 bu. 7 qt. meal last a family that uses 1 pint 3 times a day? *Ans.* 365 days.

10. A farmer bought 2 pk. 1 qt. extra quality seed-corn in one-pint packages @ \$.15 per pint; find the cost. *Ans.* \$5.10.

11. If 3 quarts of oats be given to each of 4 mules 3 times per day, in how many days will they eat 90 bushels? *Ans.* 80 days.

12. Reduce 167 pt. to bushels.

ANALYSIS.		PROCESS.	
1 pt. = $\frac{1}{2}$ qt.		2	167 pt.
167 pt. = $1\frac{1}{2}$ qt. = 83 qt. + 1 pt.		8	83 qt. + 1 pt.
1 qt. = $\frac{1}{8}$ pk.		4	10 pk. + 3 qt.
83 qt. = $8\frac{3}{8}$ pk. = 10 pk. + 3 qt.			2 bu. + 2 pk.
1 pk. = $\frac{1}{4}$ bu.			
10 pk. = $2\frac{1}{2}$ bu. = 2 bu. + 2 pk.			

In 167 pints there are 2 bu. 2 pk. 3 qt. 1 pt.

13. Reduce 672 pk. to bushels. *Ans.* 168 bu.
 14. Reduce 579 pt. to bushels. *Ans.* 9 bu. 1 qt. 1 pt.

15. Reduce $\frac{1}{4}$ bu. to pints.

ANALYSIS.

$$1 \text{ bu.} = 64 \text{ pt.}$$

$$\frac{1}{4} \text{ bu.} = \frac{1}{4} \times 64 \text{ pt.} = 16 \text{ pt.}$$

16. Reduce 3 qt. to the fraction of a bushel.

ANALYSIS.

$$32 \text{ qt.} = 1 \text{ bu.}$$

$$1 \text{ qt.} = \frac{1}{32} \text{ bu.}$$

$$3 \text{ qt.} = 3 \times \frac{1}{32} \text{ bu.} = \frac{3}{32} \text{ bu.}$$

17. Reduce 3 pk. 1 qt. to the fraction of a bushel.

Ans. —.

LIQUID MEASURES.

The liquid measures in common use are gills, pints, quarts, and gallons. They are used in estimating quantities of liquids; such as water, oil, milk, etc.

• Tables of Liquid Measures.

$$4 \text{ gi.} = 1 \text{ pt.}$$

$$1 \text{ pt.} = 4 \text{ gi.}$$

$$2 \text{ pt.} = 1 \text{ qt.}$$

$$1 \text{ qt.} = 2 \text{ pt.} = 8 \text{ gi.}$$

$$4 \text{ qt.} = 1 \text{ gal.}$$

$$1 \text{ gal.} = 4 \text{ qt.} = 8 \text{ pt.} = 32 \text{ gi.}$$

WRITTEN WORK.

1. How many gills of water are there in a barrel containing $31\frac{1}{2}$ gal. ?

Ans. 1 008 gi.

2. Find the cost of 31 gal. 2 qt. vinegar @ \$.09 per qt.

Ans. \$11.34.

3. How long will 5 gal. kerosene oil last if $1\frac{1}{4}$ pt. is used per day ?

Ans. 32 days.

4. At \$.30 per gal. what is the cost of $2\frac{1}{2}$ pt. oil ?

5. Mrs. C. buys every day 1 quart of milk at \$.05 per pint; how much does she pay for milk in a common year ?

Ans. \$36.50.

How many gallons does she buy during the year ?

Ans. $91\frac{1}{4}$ gal.

6. Reduce 37 gal. 1 gi. to gills.

Ans. 1 185 gi.

7. Reduce 489 gi. to gallons.

Ans. 15 gal. 1 qt. 1 gi.

8. Reduce 600 qt. to gills.

Ans. 4 800 gi.

9. Reduce 1 650 gal. to pints.

Ans. 13 200 pt.

10. Reduce 799 gi. to quarts.

Ans. 99 qt. 1 pt. 3 gi.

MEASURES OF AVOIRDUPOIS WEIGHT.

The measures of Avoirdupois weight in common use are ounces, pounds, hundredweight, and tons. They are used in estimating the weight of heavy articles.

Tables of Avoirdupois Weight.

16 oz. = 1 lb.	1 lb. = 16 oz.
100 lb. = 1 cwt.	1 cwt. = 100 lb. = 1 600 oz.
20 cwt. = 1 T.	1 ton = 20 cwt. = 2 000 lb. = 32 000 oz.

The Long Ton (2 240 lb.) is used at the U. S. custom houses, and in weighing coal, iron, etc., at the mines.

WRITTEN WORK.

1. Reduce 3 T. 2 cwt. 17 lb. to pounds. *Ans.* 6 217 lb.
2. How many tons in 37 268 lb.? *Ans.* 18 T. 12 cwt. 68 lb.
3. What is the cost of 40 000 lb. hay at \$16.50 per ton?
Ans. \$330.
4. Find the freight charges on 30 000 lb. corn at \$.15 per cwt.
Ans. \$45.00.
5. For his board, and \$.45 per cwt., a man picked cotton for 6 days, averaging 220 lb. per day; how much money did he receive?
Ans. \$5.94.
6. How many ounces are 3 T. 20 lb. 13 oz.? *Ans.* 96 333 oz.
7. At 72 lb. to the bushel, how many ounces will 16½ bu. corn in the shuck weigh?
Ans. 19 008 oz.
8. At 151 lb. to the bushel, how many sacks, each to contain 2 bu., will be required to hold 1 208 tons of salt?
Ans. 8 000 sacks.
9. At \$.01 for every 2 ounces, what will it cost to send by mail a package of books weighing 4 lb.? *Ans.* \$.32.
10. Bought 2½ T. hay at \$16.50 per T., 2 T. fodder at \$.90 per cwt., 1 T. cotton-seed, 32 lb. to the bushel, at \$.20 per bu.; find the cost.
Ans. \$89.75.
11. Reduce 3 075 oz. to tons. *Ans.* —.
12. Reduce 9 oz. to the fraction of a ton. *Ans.* —.

MEASURES OF TIME.

The measures of time are seconds, minutes, hours, days, weeks, and years.

Tables of Time Measures.

60 sec. = 1 min.	1 min. = 60 sec.
60 min. = 1 hr.	1 hr. = 60 min. = 3 600 sec.
24 hr. = 1 da.	1 da. = 24 hr. = 1 440 min. = 86 400 sec.
365 days = 1 common year ; 366 days = 1 leap-year.	
In business transactions, 30 da. = 1 month ; 360 da. = 1 yr.	

The following measures of time are also used :

7 days = 1 week. 12 months = 1 year. 100 years = 1 century.

The Seasons.

SPRING.				AUTUMN OF FALL.			
March,	3d	month,	31 days.	September,	9th	month,	30 days.
April,	4th	"	30 "	October,	10th	"	31 "
May,	5th	"	31 "	November,	11th	"	30 "
SUMMER.				WINTER.			
June,	6th	month,	30 days.	December,	12th	month,	31 days.
July,	7th	"	31 "	January,	1st	"	31 "
August,	8th	"	31 "	February,	2d	"	28 "

In a leap-year February has 29 days.

To be a leap-year, the number of the year must be exactly divisible by 4 ; and, if it be divisible by 100, it must be divisible by 400 also.

The year 1900 will not be a leap-year : the number 1900 is a multiple of 4 and of 100, but it is not a multiple of 400 : the year 2000 will be a leap-year.

WRITTEN WORK.

1. How many days were in the years 1790 to 1800, including both ? *Ans.* 4 017 da.

2. If a train run $\frac{5}{8}$ mile per minute, how many miles will it run in 1 hour ? *Ans.* $37\frac{1}{2}$ mi.

3. If John can shell 1 peck of corn in 12 minutes, in how many hours, at the same rate, can he shell 3 bushels of corn ? *Ans.* 2 hr. 24 min.

4. Reduce 14 da. 3 hr. 40 min. 27 sec. to seconds. Ans. —.
5. Reduce 1 222 827 seconds to days. Ans. —.
6. Find the number of hours in all the leap-years in the nineteenth century. Ans. 210 816 hr.
7. Find the number of days that were in the last quarter of the eighteenth century. Ans. 9 131 days.
8. At the rate of 12 mi. per hour, in how many days will a vessel sail 2 460 miles? Ans. 8 da. 13 hr.
9. A cow gives 5 quarts of milk twice a day; how many gallons does she give in 8 weeks? Ans. 140 gal.
10. If a baker sells 65 loaves of bread per day, how many does he sell during August? Ans. 2 015 loaves.
11. Reduce $\frac{1}{4}$ da. to seconds.

LINEAR MEASURES.

Linear, or line measures, in common use are inches, feet, yards, rods (called also perches and poles), and miles. They are used in estimating distance and length, width, etc.

Tables of Linear Measures.

12 in. = 1 ft.		1 ft. = 12 in.
3 ft. = 1 yd.	1 yd. =	3 ft. = 36 in.
$5\frac{1}{2}$ yd. = 1 rd.	1 rd. = $5\frac{1}{2}$ yd. =	$16\frac{1}{2}$ ft. = 198 in.
320 rd. = 1 mi.	1 mi. = 320 rd. = 1 760 yd. = 5 280 ft. = 63 360 in.	

WRITTEN WORK.

1. Reduce 1 yd. to the fraction of a rod.
2. Reduce $\frac{4}{11}$ rd. to yards.
3. Reduce 1 rd. 1 yd. to yards.

ANALYSIS.

$$\begin{array}{rcl}
 1 \text{ rd.} & = & 5\frac{1}{2} \text{ yd.} \\
 1 \text{ yd.} & = & 1 \text{ yd.} \\
 \hline
 1 \text{ rd. } 1 \text{ yd.} & = & 6\frac{1}{2} \text{ yd.} = 6 \text{ yd. } 1 \text{ ft. } 6 \text{ in.}
 \end{array}$$

4. Reduce 6 yd. 1 ft. 6 in. to rods.

ANALYSIS.

$$\begin{array}{rcl} 6 \text{ yd.} & = & 1 \text{ rd. } \frac{1}{2} \text{ yd.} : \frac{1}{2} \text{ yd.} = 1 \text{ ft. 6 in.} \\ 6 \text{ yd.} & = & 1 \text{ rd. 1 ft. 6 in.} \\ 1 \text{ ft.} & = & 1 \text{ ft. 0 in.} \\ 6 \text{ in.} & = & 6 \text{ in.} \end{array}$$

$$6 \text{ yd. 1 ft. 6 in.} = 1 \text{ rd. 2 ft. 12 in.} : 2 \text{ ft. 12 in.} = 1 \text{ yd.}$$

$$6 \text{ yd. 1 ft. 6 in.} = 1 \text{ rod, 1 yard.}$$

5. Reduce 9 yd. to rods.
6. Reduce 1 439 inches to rods.

SHORT ANALYSIS.

$$1\,439 \text{ in.} = 1\,439 \text{ rd.} \div 198 = 7 \text{ rd.} + 53 \text{ inches.}$$

$$53 \text{ in.} = 53 \text{ yd.} \div 36 = 1 \text{ yd.} + 17 \text{ "}$$

$$17 \text{ in.} = 17 \text{ ft.} \div 12 = 1 \text{ ft.} + 5 \text{ "}$$

$$1\,439 \text{ inches} = 7 \text{ rd. 1 yd. 1 ft. 5 in.}$$

SECOND ANALYSIS.

$$1\,439 \text{ in.} = 1\,439 \text{ ft.} \div 12 = 119 \text{ ft.} + 11 \text{ in.}$$

$$119 \text{ ft.} = 119 \text{ yd.} \div 3 = 39 \text{ yd.} + 2 \text{ ft.}$$

$$39 \text{ yd.} = 39 \text{ rd.} \div 5\frac{1}{2} = 7 \text{ rd.} + \frac{1}{2} \text{ yd.}$$

$$\text{In } 1\,439 \text{ inches there are } 7 \text{ rd. } \frac{1}{2} \text{ yd. 2 ft. 11 in.}$$

rd.	yd.	ft.	in.	rd.	yd.	ft.	in.
7 rd.	= 7	0	0	0	17 in.	=	1 5
$\frac{1}{2}$ yd.	=	1	6	3 ft.	=	1 0	0
2 ft.	=	2	0	7 rd.	= 7		
11 in.	=		11	Total =	7	1	1 5
Total =	7	0	3 17				

$$1\,439 \text{ inches} = 7 \text{ rd. 1 yd. 1 ft. 5 in.}$$

(The first analysis requires a knowledge of the number of inches in a yard, and in a rod; it is much less intricate than the second.)

7. How many rods are in $3\frac{1}{2}$ miles?
8. How many rods are in 1 520 inches?
9. Find the number of rods around a square field measuring $\frac{3}{4}$ mile to the side. *Ans.* 512 rd.
10. Find the number of rods around a square field measuring 880 yd. to the side. *Ans.* 640 rd.
11. How many yards are in 1 mi. 2 rd.? *Ans.* 1 771 yd.
12. How many feet are in 3 mi. 4 rd.?

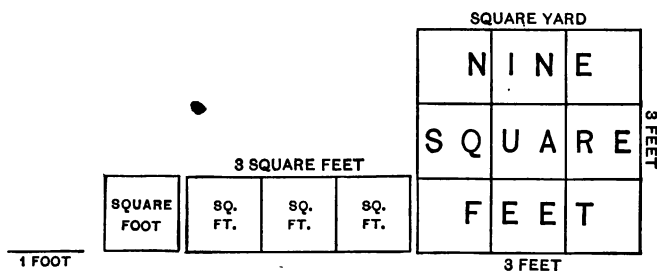
SQUARE MEASURES.

The square measures in common use are square inches, square feet, square yards, square rods or perches, acres, and square miles. They are used in estimating surfaces.

Tables of Square Measures.

144 sq. in. = 1 sq. ft.	1 sq. ft. = 144 sq. in.
9 sq. ft. = 1 sq. yd.	1 sq. yd. = 9 sq. ft. = 1 296 sq. in.
30 $\frac{1}{4}$ sq. yd. = 1 sq. rd.	1 sq. rd. = 30 $\frac{1}{4}$ sq. yd. = 272 $\frac{1}{4}$ sq. ft.
160 sq. rd. = 1 A.	1 A. = 160 sq. rd. = 4 840 sq. yd. = 43 560 sq. ft.
640 A. = 1 sq. mi.	

In surveying land a chain called Gunter's chain is used. It is 66 ft., or 4 rods, in length. It has 100 links, each of which is 7.92 in. long. 1 sq. chain = 16 sq. rd; 10 sq. ch. = 1 A.

**WRITTEN WORK.**

- Find the number of square feet in a rectangular surface 4 feet long and 3 feet wide.

A surface 1 ft. long, 1 ft. wide = 1 square foot.

" " 4 ft. long, 1 ft. wide = 4×1 sq. ft. = 4 sq. ft.

" " 4 ft. long, 3 ft. wide = 3×4 sq. ft. = 12 sq. ft.

- Find the area, in square feet, of a lot 100 feet long, 50 feet wide.

- How many acres in a field containing 6 000 square rods?

Ans. 37 $\frac{1}{2}$ A.

- How many acres in a square field, one side of which is 40 rd. long?

Ans. 10 A.

- How many square rods are in a field whose area is 12 A. 150 sq. rd.?

Ans. 2 070 sq. rd.

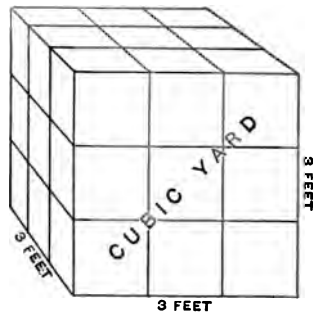
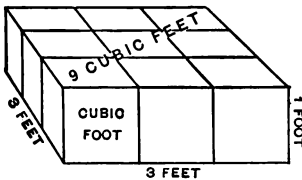
6. Find the area, in square yards, of a floor measuring 20 ft. on each side. *Ans. $44\frac{4}{9}$ sq. yd.*
7. Reduce 1 square mile to square rods. *Ans. 102 400 sq. rd.*
8. Find the number of square rods in a square garden measuring 198 ft. to the side. *Ans. 144 sq. rd.*
9. Reduce 120 square inches to the fraction of a square foot.
10. Find the area of a square field measuring $\frac{1}{2}$ mi. to the side. *Ans. 160 A.*
11. Reduce 72 sq. in. to the fraction of a square yard.
12. Find the area of a square field measuring 440 yd. to the side. *Ans. 40 A.*
13. Reduce 1 A. 1 sq. rd. 4 sq. ft. to square inches. *Ans. 6 312 420 sq. in.*
14. A rectangular field is $\frac{1}{2}$ mi. long, $\frac{1}{4}$ mi. wide. Find its area. *Ans. 80 A.*
15. Find the number of acres in a rectangular field 440 yd. wide and 1 320 yd. long. *Ans. 120 A.*

CUBIC MEASURES.

The cubic measures in common use are cubic inches, cubic feet, cubic yards, and cords. They are used in estimating solids and capacities.

Tables of Cubic Measures.

- 1 728 cu. in. = 1 cu. ft.
 27 cu. ft. = 1 cu. yd.
 128 cu. ft. = 1 cord.
 1 cu. ft. = 1 728 cu. in.
 1 cu. yd. = 46 656 cu. in.



A cube is a solid body with six equal square surfaces.
A cube has three dimensions — length, breadth, and thickness.

WRITTEN WORK.

1. Find the solid contents of a stone 4 ft. long, 3 ft. wide, and 2 ft. thick.

The solid contents

Of a stone 1 ft. long, 1 ft. wide, 1 ft. thick = 1 cu. ft.

Of a stone 4 ft. long, 1 ft. wide, 1 ft. thick = 4 cu. ft.

Of a stone 4 ft. long, 3 ft. wide, 1 ft. thick = 12 cu. ft.

Of a stone 4 ft. long, 3 ft. wide, 2 ft. thick = 24 cu. ft.

2. Find the number of cubic inches in a brick whose dimensions are 8 in., 4 in., and 2 in. *Ans.* 64 cu. in.

3. Reduce 4 000 cu. ft. to cubic yards. *Ans.* $148\frac{4}{7}$ cu. yd.

4. Reduce 39 cu. yd. 13 cu. ft. 179 cu. in. to cubic inches. *Ans.* 1 842 227 cu. in.

5. How many cubic feet in a wall 100 ft. long, 2 ft. thick, 8 ft. high? *Ans.* 1 600 cu. ft.

6. How many cubic yards in 489 888 cubic inches? *Ans.* $101\frac{1}{2}$ cu. yd.

7. How many cords in a pile of wood 40 ft. long, 4 ft. wide, 6 ft. high? *Ans.* $71\frac{1}{2}$ cords.

8. Find the number of cubic feet of air in a school-room 30 ft. long, 24 ft. wide, 15 ft. high.

9. At \$4.50 per cord, what will be the cost of a pile of wood 20 ft. by 12 ft. by 4 ft.? *Ans.* \$33.75.

10. What is the weight of a block of ice 3 ft. long, 2 ft. wide, $1\frac{1}{2}$ ft. thick, at $57\frac{1}{2}$ lb. to the cubic foot? *Ans.* $517\frac{1}{2}$ lb.

11. How many cubic yards of earth must be removed in digging a cellar 15 ft. by 12 ft. by 8 ft.? *Ans.* $53\frac{1}{3}$ cu. yd.

MISCELLANEOUS TABLES.

Paper Measures.

24 sheets = 1 quire.
20 quires = 1 ream.
2 reams = 1 bundle.
5 bundles = 1 bale.

Counting.

20 in number = 1 score.
12 " " = 1 dozen.
12 dozen = 1 gross.
12 gross = 1 great gross.

1. How many sheets of paper in 79 quires? *Ans.* —.
 2. Find the cost of $33\frac{1}{4}$ reams of paper @ \$.08 per quire.
 3. How many sheets in 1 bale and 3 quires?
 4. Henry is 17 yr. old, and his grandfather is fourscore and five years old; find the difference in their ages.
 5. In the schools of a city 36 great gross of crayons were used; how many crayons? *Ans.* —.
- Find the cost @ \$.12 per gross. *Ans.* \$51.84.

OTHER MEASURES IN USE.

The tables of weight given below are in restricted use. The various measures are not needed in solving problems in this book; for reference they will prove convenient.

TROY WEIGHT.		APOTHECARIES' WEIGHT.	
<i>Used by Jewellers.</i>		<i>Used by Physicians and Apothecaries.</i>	
24 grains	= 1 pennyweight.	24 gr.	= 1 scruple.
20 pwt.	= 1 ounce.	3 sc.	= 1 dram.
12 oz.	= 1 lb.	8 dr.	= 1 ounce.
1 lb. Troy	} = 5 760 gr.	12 oz.	= 1 lb.
1 lb. Apoth.		1 lb. Avoirdupois	= 7 000 gr.

VARIOUS.

1 quart dry measure	= 67.20	cubic inches.
1 quart liquid measure	= 57.75	" "
1 gallon	= 231	" "
1 bushel	= 2 150.42	" "
31½ gal.	= 1 barrel	} used in measuring cisterns, etc.
63 gal.	= 1 hogshead	
100 square ft.	= 1 square,	used in measuring roofs, floors, etc.
3 barleycorns	= 1 inch.	¼ in. is 1 size in shoe measure.
4 inches	= 1 hand,	used in measuring height of horses.
33½ inches	= 1 vara,	used in Spanish-American land measures.
6 ft.	= 1 fathom,	used in finding depth at sea.
160 acres	= 1 quarter-section	of land.
320 "	= 1 half-section	" "
640 "	= 1 whole section	" "
2 weeks	= 1 fortnight.	

ADDITION OF COMPOUND NUMBERS.

1. Find the sum of 5 bu. 3 pk. 7 qt. 1 pt., 7 bu. 1 pk. 1 pt., and 8 bu. 5 qt. 1 pt.

The sum of the pints is 3 pt. 3 pt. = 1 qt.
1 pt. 1 is written under pints, and 1 quart
is added to the column of quarts.

The sum of the quarts is 13 qt. 13 qt. =
1 pk. 5 qt. 5 is written under quarts, and
1 peck is added to the column of pecks.

The sum of the pecks is 5 pecks. 5 pecks
= 1 bu. 1 pk. 1 is written under pecks, and
1 bushel is added to the column of bushels.
The sum of the bushels is 21 bu.

PROCESS.			
4	8	2	
bu.	pk.	qt.	pt.
5	3	7	1
7	1	0	1
8	0	5	1
<hr/>			
21 bu. 1 pk. 5 qt. 1 pt.			

2. A farmer gives to his horses each day 3 bu. 2 pk. corn, and to his hogs 3 pk. corn, and uses for all other purposes 1 bu. 1 pk. 3 qt. corn; how much corn does he use each day?

Ans. 5 bu. 2 pk. 3 qt.

3. Add 2 T. 14 cwt. 55 lb., 3 T. 16 cwt. 49 lb., and 6 T. 18 cwt. 30 lb.

Ans. 13 T. 9 cwt. 34 lb.

4. Of an irregular field the north side is 61 rd. 4 yd. 1 ft. long, the east side is 59 rd. 1 yd. 2 ft. 10 in. long, the south side is 55 rd. 2 ft. 10 in. long, and the west side 60 rd. 3 yd. 2 ft. 4 in. long; find the distance round the field.

Ans. 237 rd.

5. Find the sum of 40 cu. yd. 20 cu. ft. 1 000 cu. in., 27 cu. yd. 14 cu. ft. 1 000 cu. in., 20 cu. yd. 10 cu. ft. 1 500 cu. in., and 11 cu. yd. 7 cu. ft. 1 684 cu. in.

Ans. 100 cu. yd.

Add:

6.				7.				8.			
da.	hr.	min.	sec.	gal.	qt.	pt.	gl.	A.	sq. rd.	sq. yd.	sq. ft.
1	4	55	30	10	3	1	3	12	120	29	8
3	19	51	59	25	1	0	2	10	119	30	6
7	22	40	20	15	2	0	3	14	68	27	2
2	13	20	30	6	1	1	2	17	140	22	7

REVIEW WORK. — Problems 6 to 10 under Factors.

SUBTRACTION OF COMPOUND NUMBERS.

1. From 17 bu. 2 pk. 3 qt. subtract 9 bu. 3 pk. 5 qt.

From 3 quarts 5 quarts cannot be subtracted. Reducing 1 of the pecks of the minuend to quarts, 8 quarts + 3 quarts = 11 quarts. 11 qt. - 5 qt. = 6 qt., which is written as the remainder of quarts.

There remains but 1 peck in the minuend. 3 pecks cannot be subtracted from 1 peck. Reducing 1 of the bushels of the minuend to pecks, 4 pecks + 1 peck = 5 pecks. 5 pk. - 3 pk. = 2 pk., which is written as the remainder of pecks.

There remain but 16 bushels in the minuend. 16 bu. - 9 bu. = 7 bu.

PROCESS.		
	4	8
bu.	pk.	qt.
17	2	3
9	3	5
<hr/>		
7 bu. 2 pk. 6 qt.		

2. Subtract 2 da. 11 hr. 52 min. 13 sec. from 12 da. 1 hr. 40 min.
- Ans.*
- 9 da. 13 hr. 47 min. 47 sec.

3. From a cask containing 10 gal. molasses enough was drawn to fill a five-gallon cask and a quart-bottle; how much molasses was left in the larger cask?

4. A farmer has 100 acres in three fields; one contains 32 A. 70 sq. rd.; the second 50 A. 109 sq. rd. 10 sq. yd.; find the size of the third field.

Ans. 16 A. 140 sq. rd. 20 sq. yd. 2 sq. ft. 36 sq. in.

5. August 19, 1891, a man gave his note for a sum of money borrowed; he paid the note Sept. 1, 1892; find the length of time from the date of the note until it was paid.

Sept. 1, 1892, is the 1st day of the 9th month of the year 1892.	yr.	12	30
Aug. 19, 1891, is the 19th day of the 8th month of the year 1891.	mo.	9	1
	da.	1892	1891
		9	8
		1	19

6. Find the difference in time between June 18, 1815, and April 12, 1861.
- Ans.*
- 45 yr. 9 mo. 24 da.

7. Find the difference in time between Dec. 22, 1890, and Jan. 19, 1893.
- Ans.*
- 2 yr. 27 da.

	8.			9.			10.				
	yr.	mo.	da.	cwt.	lb.	oz.	mi.	rd.	yd.	ft.	in.
	1894	3	4	10	40	6	6 ¹	105	4	2	6
Subtract	1893	5	16	9	58	15	3	150	3	2	9

MULTIPLICATION OF COMPOUND NUMBERS.

1. Multiply 4 bu. 3 pk. 3 qt. by 8.

The product of 3 qt. by 8 = 24 qt. 24 qt. = 3 pk. 0 qt. The 0 is not written in the product.

The product of 3 pk. by 8 = 24 pk. 24 pk. + 3 pk. = 27 pk. = 6 bu. 3 pk. The 3 pk. is written in the product.

The product of 4 bu. by 8 is 32 bu. 32 bu. + 6 bu. = 38 bu., which is written in the product.

PROCESS.		
bu.	pk.	qt.
4	3	3
		8
<hr/>		
38 bu. 3 pk.		

2. How much coal in 9 loads, each weighing 15 cwt. 40 lb.?

Ans. 6 T. 18 cwt. 60 lb.

3. How much milk does a dairyman sell in 7 weeks, at the rate of 98 gal. 3 qt. 1 pt. per week?

4. If he makes a profit of \$.02 per qt., what is his gain on milk in the 7 weeks?

Ans. \$55.37.

5. Find the distance around a square field one side of which is 38 rd. 2 yd. 2 ft. long.

Ans. 153 rd. 5 yd. 6 in.

6. A square field, 60 rd. to the side, is
- $\frac{1}{8}$
- of a man's farm; how many acres in the farm?

Ans. 180 A.

	7.				8.				9.				
	mi.	rd.	yd.	ft.	mi.	rd.	yd.	ft.	mi.	rd.	yd.	ft.	in.
Multiply	3	49	4	2	17	58	5	1	29	148	3	0	9
				9				15					69
	<hr/>				<hr/>				<hr/>				

DIVISION OF COMPOUND NUMBERS.

1. What is
- $\frac{1}{8}$
- of 19 bu. 3 pk. 5 qt. 1 pt.?

$\frac{1}{8}$ of 19 bu. = 3 bu. + 4 bu. remainder.

The 4 bu. remainder = 16 pecks. 16 pk.

+ 3 pk. = 19 pecks.

$\frac{1}{8}$ of 19 pk. = 3 pk. + 4 pk. remainder.

The 4 pk. remainder = 32 quarts. 32 qt.

+ 5 qt. = 37 qt.

$\frac{1}{8}$ of 37 qt. = 7 qt. + 2 qt. remainder.

The 2 qt. remainder = 4 pt. 4 pt. + 1 pt. = 5 pt. $\frac{1}{8}$ of 5 pt. = 1 pint.

PROCESS.			
bu.	pk.	qt.	pt.
5)19	3	5	1
<hr/>			
3 bu. 3 pk. 7 qt. 1 pt.			

2. Divide 3 T. 14 cwt. 70 lb. 6 oz. by 5.
3. A field of 100 acres is in wheat, oats, and rye; $\frac{3}{8}$ of the field is in wheat, and $\frac{1}{4}$ in rye; how much land is in oats?
Ans. 37 A. 80 sq. rd.
4. Find $\frac{1}{2}$ of a week. *Ans.* 1 da. 9 hr. 36 min.
5. The census report shows that in a certain county there are 950 farms, containing in all 134 995 acres; find the size of the average farm. *Ans.* 142 A. 16 sq. rd.
6. The dividend is 15 bu. 6 qt.; the divisor is 3 bu. 2 pk. 1 qt.; reduce both to quarts, and find the quotient. *Ans.* 6.
7. The dividend is 25 gal. 3 qt. 1 pt.; the divisor is 6 gal.; find the quotient. *Ans.* $4\frac{5}{12}$.
8. How many sacks, each to contain 2 bu. 2 pk., will hold 320 bu. oats? *Ans.* 128 sacks.
9. Divide 40 mi. 40 rd. 5 yd. 2 ft. 6 in. by 9.
10. Divide 40 sq. mi. 50 A. 60 sq. rd. by 9.

REVIEW.

1. A dairyman sells daily to each of 42 customers 1 pt. milk; to each of 15 customers, 1 qt.; to each of 8 customers, 2 qt.; to each of 6 customers, 3 qt.; and to each of 5 customers, 1 gal.; how much does he sell a day? *Ans.* 22 gal. 2 qt.
2. A rectangular field is 1 mi. 80 rd. long, and $\frac{3}{4}$ mi. wide; find the cost of a fence around it at 25 ¢ per rd. *Ans.* \$320.
3. How many steps, averaging 28 in., will a soldier take in marching 14 miles? *Ans.* 31 680 steps.
4. How many flag-stones, each 3 ft. by 2 ft., should be bought to pave a walk 17 yd. long and 4 ft. wide?
5. A field 100 rd. long, 80 rd. wide, produced $23\frac{1}{2}$ bu. wheat per acre; find the value of the wheat @ \$.75 per bushel.
Ans. \$881.25.
6. One fourth of a man's property is a farm of 81 A. 100 sq. rd., valued at \$16 per acre; find the entire value of his property. *Ans.* \$5224.
7. In 217 lb. corn there are 3 bu. 3 pk. 4 qt.; how many bushels in 1085 lb. corn? *Ans.* 19 bu. 1 pk. 4 qt.

8. What fraction of a bushel is $\frac{1}{4}$ of a peck ?
9. What fraction of a bushel is 2 pk. 2 qt. ? *Ans.* $\frac{9}{16}$ bu.
10. How much grain will three bins hold, if they will hold, respectively, 17 bu. 3 pk., 21 bu. 2 pk., and 29 bu. 3 pk. ?
11. A grocer sold 379 pk. sweet potatoes @ \$.80 per bushel ; how many bushels did he sell ? How much did he receive for them ? *Ans.* \$75.80.
12. Find the sum of $\frac{1}{2}$ bu. $\frac{1}{2}$ pk. $\frac{1}{2}$ qt. *Ans.* $20\frac{1}{2}$ qt.
13. Find the sum of .125 bu. and .5 pk. *Ans.* 1 pk.
14. A man paid \$6 for milk at \$.03 per pint ; how many gallons did he buy ?
15. Find the sum of $\frac{3}{8}$ gal., $\frac{1}{2}$ qt., and $\frac{3}{8}$ pt. *Ans.* $4\frac{3}{8}$ pt.
16. To travel by rail 900 miles in one day, what must be the average rate of travel per hour ? *Ans.* 37 mi. 160 rd.
17. A garden is 9 rd. 2 yd. 2 ft. long, and 7 rd. 3 yd. 8 in. wide ; how much greater is its length than its breadth ? *Ans.* 1 rd. 4 yd. 2 ft. 10 in.
18. A mason built 400 ft. of brick wall @ \$10 per rod ; how much did he receive ? *Ans.* \$242.42.
19. How many yards of matting a yard wide will be required to cover the floors of 2 rooms, each 15 ft. by 18 ft. ? What will be the cost of the matting @ \$.27 $\frac{1}{2}$ per yd. ? *Ans.* \$16.50.
20. How many square yards of paving on Main Street, which is 60 ft. wide, and is paved for $1\frac{1}{4}$ miles ? What did the paving cost @ \$2.62 $\frac{1}{2}$ per sq. yd. ? *Ans.* \$115 500.
21. How many sheets of paper, 15 in. by $8\frac{1}{2}$ in., can be cut from a roll of paper 80 ft. long, 17 in. wide ? *Ans.* 128 pieces.
22. A farmer's garden is 10 rd. by 8 rd. ; his meadow is 60 rd. square ; how much more land is in the meadow than in the garden ? *Ans.* 22 A.
23. What is the sum, in square miles, of 50 sq. mi. and 50 miles square ? *Ans.* 2 550 sq. mi.
24. What part of an acre is covered by a building 60 ft. long by 33 ft. wide ? *Ans.* $\frac{1}{22}$ A.

25. Into how many 40-acre farms could a prairie 6 miles square be divided? *Ans.* 576 farms.

26. A teamster hauls 30 cu. ft. of earth at a load; how many loads will he haul in carrying the earth dug from a cellar 20 ft. long, 15 ft. wide, 8 ft. deep? *Ans.* 80 loads.

27. At $2\frac{1}{4}$ cents per square yard, what will it cost to paint the floor of a public hall 60 ft. by 48 ft.? *Ans.* \$8.80.

28. Mr. Butler's farm contains 2 000 acres; its form is rectangular; its length is 640 rd.; what is its width? *Ans.* 500 rd.

29. Arkansas contains 53 850 square miles; the census of 1890 showed its population to be 1 128 179; how many acres to the person? *Ans.* 30.548 + A.

30. How many cubic feet of water in a pond covering an acre, and averaging 3 feet in depth? *Ans.* 130 680 cu. ft.

31. How many cubic yards of water in a lake covering 10 acres, and averaging 15 feet in depth? *Ans.* 726 000 cu. yd.

32. A dealer bought 50 000 lb. corn for \$550, and sold it at \$.63 per bushel of 56 lb.; find his profit. *Ans.* \$12.50.

33. A dealer bought 8 000 lb. oats at \$.30 per bushel of 32 lb., and sold the whole for \$70; find the gain or loss. *Ans.* Loss, \$5.

34. A dealer bought 18 000 lb. wheat at \$.90 per bushel of 60 lb., and 15 400 lb. ear-corn at \$.50 per bushel of 70 lb., and sold the whole for \$400; find the gain or loss. *Ans.* Gain, \$20.

35. Find the cost of 2 500 lb. corn-meal at \$.60 per bushel of 48 lb. *Ans.* \$31.25.

36. In one gallon there are 231 cu. in. A tank whose inside dimensions are 18 ft. by 12 ft. by 10 ft. will hold how many gallons of water? *Ans.* 16 157.922 + gal.

37. In one bushel there are 2 150.42 cu. in. A crib whose inside dimensions are 20 ft. by 18 ft. by 12 ft. will hold how many bushels of wheat? *Ans.* 3 471.39 + bu.

PERCENTAGE.

ORAL WORK.

1. A man rode on a train 25 miles for 75 cents; what rate did he pay per mile?
2. A man rode on a train 300 miles for \$9; what rate did he pay per hundred miles?
3. A cotton picker received \$5 for picking 1 000 lb. cotton; at what rate per hundred pounds was he paid?
4. A nickel is how many hundredths of 100 cents?
5. A year is how many hundredths of a century?
6. A quarter-dollar is how many hundredths of a dollar?
7. Twenty-five years are how many hundredths of a century?

Per cent (%) means per *hundred*.

8. How many hundredths of \$1 is 1 dime?
9. How many hundredths of 1 bushel is 1 peck?
10. How many hundredths of 1 cwt. is 5 lb.?
11. How many hundredths of 1 gallon is 1 quart?
12. A half-gallon measure holds $\frac{50}{100}$ of what measure?
13. A peck measure holds .25 of what measure?
 $\frac{25}{100}$, .25, and 25% all mean the same thing.
14. How many hundredths of 50 is 5? What per cent of 60 is 6?
15. How many hundredths of 100 is 5? What per cent of 80 is 8?
16. What per cent of 100 is 8? 9? 10? 12? 15?
17. Of what number is 6 six per cent?
18. Of what number is 5 ten per cent?
19. Of what number is 5 twenty per cent?
20. What % of 5 cwt. is 5 lb.?

REVIEW WORK. — Division of Decimal Fractions.

DEFINITIONS.

The **Percentage** is the result obtained in the process of finding any per cent of a number.

The **Base** is the number of which a percentage is found.

The **Rate per cent** is the rate per hundred.

The **Amount** is the sum of the Base and its Percentage.

The sign (%) of Percentage is read *per cent*.

WRITTEN WORK.

1. Represent $\frac{3}{4}$ as a decimal fraction.
2. What per cent of a number is $\frac{3}{20}$ of it? *Ans.* 15%.
3. What per cent of a number is $\frac{5}{8}$ of it? *Ans.* 62½%.
4. What per cent of a number is $\frac{7}{8}$ of it? *Ans.* 87½%.

To find the Percentage.

5. In a field containing 200 acres, 36% of it is planted in corn; how many acres in corn?

100 % of the field = 200 acres.

1 % " " " = 2 acres.

36 % " " " = 36 × 2 A. = 72 A.

1 % of a number is found
by removing the decimal
point two places to the left.

6. A merchant sold goods to the amount of \$37 500, for 24% of which he received cash; find the amount of his cash sales. *Ans.* \$9 000.

7. A candidate received 55% of 54 000 votes; what was his majority? *Ans.* 5 400 votes.

8. A ranchman sold, at \$17 per head, 25% of 12 480 head of cattle; how much did he get? *Ans.* \$53 040.

9. Of a cargo containing 40 000 bu. wheat, 18% was spoiled; how many bushels were spoiled? *Ans.* 7 200 bu.

10. Of a crop of corn amounting to 1 260 bu., a farmer sold 30%, and kept the remainder; how many bushels did he keep? *Ans.* 882 bu.

11. In 1880 the population of a city was 15 280; during the next 10 years it increased 60%; what was the population in 1890? *Ans.* 24 448.

Find the percentage —

*Ans.
to each.*

12.	$2\frac{1}{2}\%$ of 500;	$1\frac{1}{4}\%$ of 1 000;	$\frac{5}{8}\%$ of 2 000.	12 $\frac{1}{2}$.
13.	$3\frac{1}{2}\%$ of 600;	7% of 300;	$10\frac{1}{2}\%$ of 200.	21.
14.	$3\frac{1}{3}\%$ of 990;	$6\frac{2}{3}\%$ of 495;	$12\frac{1}{2}\%$ of 264.	33.
15.	$12\frac{1}{2}\%$ of 864;	$6\frac{1}{4}\%$ of 1 728;	$6\frac{3}{4}\%$ of 1 600.	108.
16.	$16\frac{2}{3}\%$ of 966;	$8\frac{1}{3}\%$ of 1 932;	$33\frac{1}{3}\%$ of 483.	161.
17.	$18\frac{3}{4}\%$ of 300;	$12\frac{1}{2}\%$ of 450;	$3\frac{1}{5}\%$ of 1 800.	56 $\frac{1}{4}$.
18.	$22\frac{1}{2}\%$ of 180;	$7\frac{1}{2}\%$ of 540;	$2\frac{1}{2}\%$ of 1 620.	40 $\frac{1}{2}$.
19.	$26\frac{1}{4}\%$ of 950;	$12\frac{1}{4}\%$ of 1 995;	$13\frac{3}{8}\%$ of 1 900.	249 $\frac{3}{8}$.
20.	$27\frac{1}{2}\%$ of 550;	$18\frac{1}{3}\%$ of 825;	$3\frac{3}{8}\%$ of 4 125.	151 $\frac{1}{4}$.
21.	$33\frac{1}{3}\%$ of 999;	$12\frac{1}{2}\%$ of 2 664;	$18\frac{1}{3}\%$ of 1 776.	333.
22.	$37\frac{1}{2}\%$ of 750;	$31\frac{1}{4}\%$ of 900;	$62\frac{1}{2}\%$ of 450.	281 $\frac{1}{4}$.
23.	$42\frac{1}{2}\%$ of 665;	$40\frac{3}{8}\%$ of 700;	$21\frac{1}{4}\%$ of 1 330.	282 $\frac{3}{8}$.
24.	$47\frac{1}{2}\%$ of 950;	$45\frac{1}{8}\%$ of 1 000;	$9\frac{1}{2}\%$ of 4 750.	451 $\frac{1}{4}$.
25.	$53\frac{1}{3}\%$ of 675;	$10\frac{3}{8}\%$ of 3 375;	$62\frac{1}{2}\%$ of 576.	360.
26.	$57\frac{1}{2}\%$ of 250;	$11\frac{1}{2}\%$ of 1 250;	$28\frac{3}{4}\%$ of 500.	143 $\frac{3}{4}$.
27.	$61\frac{3}{4}\%$ of 768;	$79\frac{1}{25}\%$ of 600;	$30\frac{1}{8}\%$ of 1 536.	474.24.
28.	$62\frac{1}{2}\%$ of 800;	$66\frac{2}{3}\%$ of 750;	$16\frac{3}{8}\%$ of 3 000.	500.
29.	$66\frac{2}{3}\%$ of 990;	$18\frac{3}{4}\%$ of 3 520;	$37\frac{1}{2}\%$ of 1 760.	660.
30.	$87\frac{1}{2}\%$ of 1 600;	$43\frac{3}{4}\%$ of 3 200;	$62\frac{1}{2}\%$ of 2 240.	1 400.

To find the Rate.

1. In a school of 80 pupils there are 44 boys; what per cent of the school are boys?

ANALYSIS.

SHORT PROCESS.

80 pupils = 100% of school.

1 pupil = $\frac{100}{80}\%$ of school.44 pupils = $44 \times \frac{100}{80}\%$ of school = 55% of school.

1% of 80 = .80.

.80)44.00(55.

2. What per cent of 16 gallons is 4 gallons? *Ans. 25%.*

3. A man bought a horse for \$150 and sold him for \$175; what per cent did he gain? *Ans. 16 $\frac{2}{3}$ %.*

4. A farm of 160 acres has 32 acres in woodland; what per cent of the farm is in woodland? *Ans. 20%.*

5. In an orchard containing 1 776 trees, 444 trees are apple-trees; what per cent are apple-trees? *Ans. 25%.*

What per cent —

6. Of 444 is 111 ? Of 500 is 125 ? Of 50 is $12\frac{1}{2}$?
Ans. to each 25%.
7. Of 660 is 33 ? Of 192 is $9\frac{3}{8}$? Of $62\frac{1}{2}$ is $3\frac{1}{8}$?
Ans. to each 5%.
8. Of 90 is 6 ? Of 225 is 15 ? Of 135 is 9 ?
Ans. to each $6\frac{2}{3}$ %.
9. Of 800 is 60 ? Of 200 is 15 ? Of 350 is $26\frac{1}{4}$?
Ans. to each $7\frac{1}{2}$ %.
10. Of 720 is 63 ? Of 1680 is 147 ? Of 1620 is $141\frac{3}{4}$?
Ans. to each $8\frac{3}{4}$ %.
11. Of 950 is 19 ? Of 375 is $7\frac{1}{2}$? Of 625 is $12\frac{1}{2}$?
Ans. to each 2%.
12. Of 725 is $217\frac{1}{2}$? Of 145 is $43\frac{1}{2}$? Of 5 is $1\frac{1}{2}$?
Ans. to each 30%.
13. Of 618 is 103 ? Of 99 is $16\frac{1}{2}$? Of 75 is $12\frac{1}{2}$?
Ans. to each $16\frac{2}{3}$ %.
14. Of 80 is 30 ? Of 75 is $28\frac{1}{8}$? Of 62 is $23\frac{1}{4}$?
Ans. to each $37\frac{1}{2}$ %.
15. Of 15 is $4\frac{3}{4}$? Of 60 is 19 ? Of 210 is $66\frac{1}{2}$?
Ans. to each $31\frac{2}{3}$ %.
16. Of \$ 756 is \$ 504 ? Of \$ 840 is \$ 560 ?
Ans. to each $66\frac{2}{3}$ %.

To find the Base.

1. A field of 30 acres is 15% of a man's farm ; how many acres in the farm ?

$$15\% \text{ of farm} = 30 \text{ acres.}$$

$$1\% \text{ of farm} = 2 \text{ acres.}$$

$$100\% \text{ of farm} = 200 \text{ acres.}$$

2. A man bought a railroad ticket for \$ 9, which was 45% of the expense of his journey ; what was the total expense ?

$$\text{Ans. } \$ 20.$$

3. Find the number of gallons of water in a cistern in which 19% of the water is 570 gal.

$$\text{Ans. } 3000 \text{ gal.}$$

4. A farmer sold 480 bu. corn, which was 24% of his crop ; how many bushels were in his entire crop ?

$$\text{Ans. } 2000 \text{ bu.}$$

5. For rent a man pays annually \$ 360, which is 18% of his salary ; what is his salary ?

$$\text{Ans. } \$ 2000.$$

6. A farm was mortgaged for \$3 680, which was 92% of its cost; find its cost. *Ans.* \$4 000.

7. At the end of the 168th mile, a train had made 35% of the day's run; find the total run for the day. *Ans.* 480 mi.

Find the base —

- | | |
|----------------------------------------|---------------------------------|
| 8. Of which 10 is 3%. | 11. Of which 36 is 25%. |
| 9. Of which 21 is 7%. | 12. Of which 42 is 12%. |
| 10. Of which 25 is $12\frac{1}{2}\%$. | 13. Of which 56 is 20%. |
| 14. Of which 15 is $4\frac{1}{2}\%$. | <i>Ans.</i> 333 $\frac{1}{3}$. |
| 15. Of which 30 is 10%. | <i>Ans.</i> —. |
| 16. Of which 16 is 8%. | <i>Ans.</i> —. |
| 17. Of which 54 is $37\frac{1}{2}\%$. | <i>Ans.</i> 144. |
| 18. Of which $10\frac{1}{2}$ is 3%. | <i>Ans.</i> 350. |
| 19. Of which 126 is 45%. | <i>Ans.</i> 280. |
| 20. Of which 72 is $6\frac{2}{3}\%$. | <i>Ans.</i> 1 080. |

REVIEW.

1. A man's property is valued at \$15 600; his debts are estimated at 26% of his property; how much does he owe? *Ans.* \$4 056.

2. A multiplicand is 2 589, of which its product is 36%; find the product. *Ans.* —.

3. A man has his house insured for \$2 400 at an annual cost of $1\frac{1}{2}\%$ of the amount insured; how much does he pay yearly? *Ans.* —.

4. A miller received for toll $14\frac{2}{3}\%$ of 5 600 lb. corn; how many pounds of corn did he receive for toll? *Ans.* 800 lb.

5. If seed-cotton contains $66\frac{2}{3}\%$ cotton seed, how many pounds of cotton seed are in 2 000 lb. seed-cotton? *Ans.* 1333 $\frac{1}{3}$ lb.

6. Out of 1 000 bundles of fodder 150 bundles spoiled; what per cent of the fodder spoiled? *Ans.* —.

7. Of 2 240 pupils enrolled, 1 904 are present; what per cent of the enrolment is present? *Ans.* 85%.

8. The divisor is 2 750; the dividend is 935; what per cent of the divisor is the dividend? *Ans.* 34%.

9. A house costing \$1 620 was repaired at an expense of \$540; the first cost was what per cent of the total cost?

Ans. 75%.

10. A coal dealer sold all but 5% of 1 000 000 lb. coal; how many tons did he sell?

Ans. 475 T.

11. The gross receipts of a railway company for 1 year were \$2 496 900, and the expense for advertising was $\frac{1}{2}\%$ of the gross receipts; how much was paid for advertising?

Ans. \$12 484.50.

12. What must a man pay as tax on \$3 500, when the rate of taxation is $1\frac{1}{4}\%$?

Ans. \$43.75.

13. A commission merchant sold 5 250 bu. corn (@ \$.60 per bushel, and charged 4% commission; what sum did he charge? How much did the owner receive?

Ans. \$3 024.

14. An agent sold a farm for \$11 200, and charged for commission $4\frac{1}{2}\%$; how much did the owner receive?

Ans. \$10 696.

15. A man paid \$125.25 tax, at the rate of $1\frac{1}{2}\%$; find the assessed valuation of his property.

Ans. \$8 350.

16. A farmer bought a piece of woodland containing 26 acres @ \$24 per acre, and paid $33\frac{1}{3}\%$ cash; how much had he yet to pay?

Ans. \$416.

17. A house valued at \$1 350 was insured for $\frac{2}{3}$ of its value at the rate of $1\frac{3}{4}\%$; what premium, or amount, was paid for the insurance?

Ans. \$15.75.

18. A man had his life insured for \$3 000, paying \$21 on each \$1 000 annually; what was his yearly payment?

19. An agent sold a house for \$1 500, and charged \$50 for selling it; what per cent did he charge?

Ans. —.

20. An auctioneer received \$16 for selling 128 bbl. damaged flour @ \$1.25 per bbl.; what per cent did he charge?

Ans. 10%.

21. A broker sold strawberries, charging 5% commission, and received for his own share \$32; find the total amount he received for the berries.

Ans. \$640.

22. A horse was bought for \$125, and sold for \$100; what per cent was lost?

Ans. 20%.

23. A horse was bought for \$100, and sold for \$125; what per cent was gained?

Ans. —.

INTEREST.

ORAL WORK.

1. What per cent of \$ 100 is \$ 6 ? Of \$ 100 is \$ 7 ?
2. If Mr. Smith borrows \$ 100 for a year, and at the end of the year pays back \$ 100, and pays \$ 6 besides for the use of the money, what per cent of \$ 100 does he pay for the use of the money ?
3. If Mr. Brown pays 7% for the use of \$ 200 for a year, how much interest does he pay ?
4. At what rate of interest did a man borrow money when he paid \$ 8 a year for the use of \$ 100 ?
5. If a man borrows \$ 100 at 9%, what amount should he pay at the end of a year ?
6. If he borrows \$ 200 at 8%, what amount should he pay at the end of the year ?
7. If a man paid \$ 9 a year for the use of money borrowed at 9%, how much money did he borrow ?
8. What is the interest of \$ 200 for 1 year at 8% ?
9. What is the interest of \$ 300 for 1 year at 7% ?
10. What is the interest of \$ 500 for 1 year at 6% ?

DEFINITIONS.

Interest is payment for the use of money.

The **Principal** is the money used, or loaned.

The **Amount** is the sum of the Principal and the Interest.

The **Rate of Interest** is the rate per dollar; it shows what per cent of the principal is charged for the use of the principal.

Any given rate is understood to be the rate per year, unless a *different period* of time is specified.

WRITTEN WORK.

1. Find the interest of \$ 600 for 3 yr. at 8%.

ANALYSIS.

Interest of \$ 600 at 1% for 1 yr. = \$6.
 " " " " 8% " 1 " = \$48.
 " " " " 8% " 3 " = \$144.

PROCESS.

\$ 6.00 Int. 1%, 1 yr.
 8

\$48.00 Int. 8%, 1 yr.

3
 \$144.00 Int. 8%, 3 yr.

In the Process the interest of \$ 600 at 1%
 is found by removing the decimal point two
 places to the left.

2. Find the interest of \$ 750 for 4 yr. at 7%. *Ans.* \$ 210.
 3. Find the interest of \$ 850 for 4 yr. at 7½%. *Ans.* \$ 255.
 4. Find the interest of \$ 950 for 4 yr. at 7½%. *Ans.* \$ 285.
 5. Find the interest of \$ 800 for 3½ yr. at 7%. *Ans.* \$ 196.
 6. Find the interest of \$ 700 for 3 yr. 6 mo. at 8%.

Find the interest of —

- | | |
|---------------------------------------|------------------------|
| 7. \$ 780 for 4 yr. 6 mo. at 7½%. | <i>Ans.</i> \$ 263.25. |
| 8. \$ 690 for 3 yr. 3 mo. at 6%. | <i>Ans.</i> \$ 134.55. |
| 9. \$ 760 for 1 yr. 6 mo. at 6½%. | <i>Ans.</i> \$ 74.10. |
| 10. \$ 1 000 for 2 yr. 9 mo. at 7%. | <i>Ans.</i> \$ 192.50. |
| 11. \$ 1 200 for 1 yr. 9 mo. at 8%. | <i>Ans.</i> \$ 168. |
| 12. \$ 350 for 1 yr. 2 mo. at 6%. | <i>Ans.</i> \$ 24.50. |
| 13. \$ 124 for 1 yr. 4 mo. at 6%. | <i>Ans.</i> \$ 9.92. |
| 14. \$ 600 for 2 yr. 4 mo. at 7%. | <i>Ans.</i> \$ 98. |
| 15. \$ 650 for 2 yr. 6 mo. at 6%. | <i>Ans.</i> \$ 97.50. |
| 16. \$ 540 for 1 yr. 4 mo. at 8%. | <i>Ans.</i> \$ 57.60. |
| 17. \$ 540 for 2 yr. 8 mo. at 8%. | <i>Ans.</i> \$ 115.20. |
| 18. \$ 480 for 1 yr. 1 mo. at 6%. | <i>Ans.</i> \$ 31.20. |
| 19. \$ 720 for 2 yr. 1 mo. at 7%. | <i>Ans.</i> \$ 105. |
| 20. \$ 840 for 3 yr. 5 mo. at 7%. | <i>Ans.</i> \$ 200.90. |
| 21. \$ 420 for 3 yr. 7 mo. at 6%. | <i>Ans.</i> \$ 90.30. |
| 22. \$ 240 for 2 yr. 7 mo. at 7%. | <i>Ans.</i> \$ 43.40. |
| 23. \$ 562.80 for 2 yr. 7 mo. at 7%. | <i>Ans.</i> \$ 101.77. |
| 24. \$ 650.20 for 3 yr. 7 mo. at 5%. | <i>Ans.</i> \$ 116.49. |
| 25. \$ 798 for 3 yr. 11 mo. at 6%. | <i>Ans.</i> \$ 187.53. |
| 26. \$ 892.25 for 2 yr. 11 mo. at 6%. | <i>Ans.</i> \$ 156.14. |

The Six Per Cent Method.

1. Find the interest of \$1 at 6% for 1 yr. 7 mo. 18 da.

At 6%, the interest

Of \$1 for 1 yr. = 6 cents (\$.06).

Of \$1 for 1 mo. = $\frac{1}{12}$ of 6¢ = $\frac{1}{2}$ ¢ (\$.005) or 5 mills.

Of \$1 for 1 da. = $\frac{1}{360}$ of 5 mills = $\frac{1}{72}$ mill (\$.000 $\frac{1}{6}$).

Hence,

The interest of \$1 at 6% for 1 yr. = \$.06.

" " " \$1 " 6% for 7 mo. = .035 ($7 \times \frac{1}{2}$ ¢).

" " " \$1 " 6% for 18 da. = .003 ($18 \times \frac{1}{6}$ mill).

Int. of \$1 at 6% for 1 yr. 7 mo. 18 da. = \$.098.

To find the interest of \$1 for any number of years :

Multiply 6 cents by the number of years.

To find the interest of \$1 for any number of months :

Multiply $\frac{1}{2}$ cent by the number of months.

To find the interest of \$1 for any number of days :

Multiply $\frac{1}{72}$ mill by the number of days.

2. Find the interest of \$1 at 6% for 2 yr. 3 mo. 10 da.

Find the interest of \$1 at 6% for —

3. 1 yr. 9 mo. 15 da.	Ans. \$.1075.
4. 2 yr. 9 mo. 15 da.	Ans. \$.1675.
5. 3 yr. 9 mo. 15 da.	Ans. \$.2275.
6. 1 yr. 6 mo. 10 da.	Ans. \$.091 $\frac{2}{3}$.
7. 2 yr. 6 mo. 10 da.	Ans. \$.151 $\frac{2}{3}$.
8. 1 yr. 1 mo. 10 da.	Ans. \$.066 $\frac{2}{3}$.
9. 2 yr. 6 mo. 15 da.	Ans. \$.1525.
10. 3 yr. 8 mo. 20 da.	Ans. \$.223 $\frac{1}{3}$.
11. 6 mo. 9 da. Ans. \$.0315.	15. 7 mo. 6 da. Ans. \$.036.
12. 5 mo. 10 da. Ans. \$.026 $\frac{2}{3}$.	16. 5 mo. 1 da. Ans. \$.025 $\frac{1}{6}$.
13. 8 mo. 15 da. Ans. \$.0425.	17. 11 mo. 7 da. Ans. \$.056 $\frac{1}{6}$.
14. 10 mo. 20 da. Ans. \$.053 $\frac{1}{3}$.	18. 11 mo. 11 da. Ans. \$.056 $\frac{2}{3}$.

19. Find the interest of \$625 for 2 yr. 6 mo. 24 da., at 6%.

Interest of \$1, at 6%

For 2 yr. = \$.12

" 6 mo. = .03

" 24 da. = .004

\$.154

625

\$.154 interest for \$1.

2500

3125

625

\$96.250 Int. for 625 times \$1.

Find the interest at 6% —

- | | |
|-----------------------------------------|------------------------|
| 20. Of \$ 642 for 2 yr. 6 mo. | <i>Ans.</i> \$ 96.30. |
| 21. Of \$ 32.20 for 1 yr. 10 mo. | <i>Ans.</i> \$ 3.542. |
| 22. Of \$ 92.40 for 1 yr. 24 da. | <i>Ans.</i> \$ 5.913. |
| 23. Of \$ 89.50 for 2 yr. 1 mo. 6 da. | <i>Ans.</i> \$ 11.277. |
| 24. Of \$ 150 for 1 yr. 11 mo. | <i>Ans.</i> \$ 17.25. |
| 25. Of \$ 456 for 2 yr. 6 mo. 20 da. | <i>Ans.</i> \$ 69.92. |
| 26. Of \$ 600 for 3 yr. 9 mo. 6 da. | <i>Ans.</i> \$ 135.60. |
| 27. Of \$ 759.50 for 1 yr. 1 mo. 15 da. | <i>Ans.</i> \$ 51.266. |
| 28. Of \$ 800 for 3 yr. 11 mo. 12 da. | <i>Ans.</i> \$ 189.60. |

29. Dec. 15, 1889, a man borrowed \$ 450, at 7%, and paid principal and interest June 6, 1892; what amount did he pay?

1892	6	6	Int. of \$ 450 at 6% =	$450 \times \$.1485$	
1889	12	15		$450 \times \$.1485 =$	\$ 66.825
2 yr. 5 mo. 21 da.			Int. of \$ 450 at 7% =	$1\frac{1}{2} \times \$66.825$	
Interest of \$ 1 at 6%				$1\frac{1}{2} \times \$66.825 =$	\$ 77.962
for 2 yr. 5 mo. 21 da. =				450.	Interest.
\$.1485.				\$ 527.962	Principal.
					<i>Amount.</i>

30. Find the amount of \$ 640 from Feb. 1, 1890, to Jan. 1, 1892, at 7%. *Ans.* \$ 725.866.

31. Find the interest of \$ 840 from July 3, 1889, to Feb. 1, 1891, at 7%. *Ans.* \$ 92.773.

32. Find the amount of \$ 650 from July 19, 1890, to May 4, 1892, at 7%. *Ans.* \$ 731.52.

33. Find the interest of \$ 750 from Nov. 18, 1891, to Jan. 1, 1893, at 8%. *Ans.* \$ 67.166.

34. Find the interest of \$ 630 from June 15, 1891, to May 31, 1892, at 5%. *Ans.* \$ 30.274.

35. Find the amount of \$ 638.50 from July 6, 1889, to Dec. 1, 1892, at 8%. *Ans.* \$ 812.313.

36. What is the interest of \$ 757.25 from May 29, 1890, to Mar. 10, 1891, at 7%? *Ans.* \$ 41.374.

37. What is the interest of \$ 2 557.75 from Apr. 16, 1889, to Dec. 19, 1892, at 8%? *Ans.* \$ 751.977.

38. What is the amount of \$ 3 372.60 from Oct. 18, 1891, to Jan. 1, 1893, at 8%? *Ans.* \$ 3 697.119.

39. What is the amount of \$2 975.55 from Aug. 6, 1889, to Sept. 1, 1891, at 7% ? *Ans.* \$3 406.59.

40. What is the amount of \$5 350 from Dec. 22, 1889, to Nov. 18, 1891, at 8% ? *Ans.* \$6 165.557.

41. What is the amount of \$478.65 from Mar. 20, 1888, to Apr. 19, 1890, at 7% ? *Ans.* \$548.359.

42. Find the interest of \$6 010 from Nov. 26, 1890, to Mar. 7, 1892, at 7%. *Ans.* \$538.729.

43. Find the amount of \$5 125 from Apr. 16, 1889, to June 15, 1892, at 7%. *Ans.* \$6 260.044.

44. Find the interest of \$7 500 from July 3, 1890, to June 1, 1891, at 9%. *Ans.* \$615.

45. Find the interest of \$1 875.50 from Oct. 22, 1890, to Apr. 8, 1891, at 9%. *Ans.* \$77.833.

46. Find the amount of \$228.75 from Nov. 18, 1891, to May 17, 1892, at 10%. *Ans.* \$240.123.

\$525 $\frac{25}{100}$

Galveston, Texas, June 9, 1890.

For value received I promise to pay on demand to

George F. Jones

or order

Five hundred twenty-five $\frac{25}{100}$ Dollars

with interest at (8%) eight per cent per annum.

F. R. Thomas.

47. Mr. Thomas paid in full the note copied above on May 1, 1891. How much did he pay ? *Ans.* \$562.83.

48. A note was given June 6, 1889, for \$350, at 8%, and was paid Aug. 3, of the same year; find the amount paid. *Ans.* \$354.42.

49. Find the amount of a note for \$550, at 7%, given May 8, 1890, and paid June 1, 1891. *Ans.* \$590.95.

50. Find amount of note for \$675.50, at 8%, given June 1, 1891, and paid May 17, 1892. *Ans.* \$727.43.

51. Find amount of note for \$850, at 7%, given Mar. 4, 1892, and paid Aug. 1, 1892. *Ans.* \$874.29.

52. Find amount of note for \$725.50, at 8%, given June 6, 1890, and paid Apr. 5, 1892. *Ans.* \$831.74.

53. Find amount of note for \$762, at 8%, given Sept. 17, 1891, and paid July 14, 1892. *Ans.* \$812.29.

54. Find amount of note for \$1500, at 7%, given Oct. 20, 1890, and paid Feb. 4, 1892. *Ans.* \$1635.33.

55. Find amount of note for \$1750, at 7%, given May 6, 1891, and paid Apr. 7, 1892. *Ans.* \$1862.63.

56. Find amount of note for \$956.50, at 8%, given June 3, 1890, and paid May 2, 1892. *Ans.* \$1102.95.

57. A note for \$342.75, dated June 8, 1890, was paid Nov. 14, 1891, with interest at 8%; what was the amount paid? *Ans.* \$382.05.

58. Find amount of note for \$620, at 7%, given Apr. 6, 1890, and paid May 2, 1892. *Ans.* \$709.93.

59. Find amount of note for \$745.50, at 7%, given July 6, 1889, and paid June 5, 1891. *Ans.* \$845.37.

60. Find amount of note for \$645.75, at 9%, given Sept. 1, 1891, and paid Apr. 18, 1892. *Ans.* \$682.39.

61. Find amount of note for \$759.50, at 8%, given July 6, 1891, and paid Apr. 1, 1892. *Ans.* \$804.22.

62. Find amount of note for \$630.75, at 7%, given Apr. 26, 1888, and paid Jan. 1, 1890. *Ans.* \$704.95.

To compute interest at 6%:

Find the interest of \$1 for the given time at 6%. Multiply the interest thus found by the number that shows how many times \$1 is contained in the principal.

To compute interest at any per cent:

Find the interest of the given principal for the given time at 6%. Multiply the interest thus found by one-sixth of the given rate.

<p>\$500 ⁰⁰/₁₀₀</p>	<p>Dallas, Texas, Sept. 14, 1892.</p>
<p><i>Ninety days</i> after date <i>I</i> promise to pay to the order of <i>The North Texas National Bank</i> <i>Five Hundred</i> ⁰⁰/₁₀₀ <i>Dollars</i> at its Banking Office, Dallas, Texas, for value received, with interest at the rate of ¹⁰/₁₀₀ per cent per annum from <i>Maturity</i> until paid.</p>	
<p><i>W. H. Brown.</i></p>	
<p>Due <i>Dec. 16, 1892.</i></p>	

(A note becomes *due* three days after it is payable.)

11. Find the proceeds of the note copied above, the rate of discount being 10%. *Ans.* \$487.08.

12. Find the proceeds of a note for \$180, dated Apr. 16, 1892, and payable July 4, 1892, discounted in bank at 12%.

PROCESS.

In April 14 days.	180	
In May 31 "	\$.0134	
In June 30 "	120	
In July 4 "	540	
Days of grace 3.	180	
82 days.	\$2.460	discount at 6%.
Bank discount on \$1 at 6% for	2	
82 days = \$.0134.	\$4.920	discount at 12%.
\$180 - \$4.92 = \$175.08 (Proceeds).		

13. Find the proceeds of a note for \$250, dated May 18, 1892, and payable Aug. 6, 1892, discounted in bank at 9%.

Ans. \$244.81.

14. Find the proceeds of a note for \$375, dated June 6, 1892, and payable Sept. 3, 1892, discounted in bank at 9%.

Ans. \$336.37.

(A person guarantees the payment of a note by writing his name across its back; this is called *indorsing* it.)

GENERAL REVIEW.

1. Make a receipted bill for 175 lb. bacon @ \$.08 $\frac{1}{4}$; 60 lb. sugar @ \$.06; 15 lb. coffee @ \$.25; 36 gal. molasses @ \$.42; and 3 bbl. flour @ \$5.25. *Ans.* \$53.53.

2. Divide \$150.75 between two men so that one shall receive $\frac{1}{2}$ as much as the other. *Ans.* \$50.25, \$100.50.

3. Find the interest, at 7%, on \$315.75 for 1 yr. 3 mo. 3 da. *Ans.* \$27.812.

4. How far is it from D. to G. if a train makes the distance in 13 $\frac{1}{2}$ hr., running at the rate of 27 $\frac{1}{2}$ mi. per hour? *Ans.* 371 $\frac{1}{2}$ mi.

5. Find one of the equal numbers, 14 $\frac{1}{2}$ of which being added together make the sum 105 $\frac{1}{8}$. *Ans.* 7 $\frac{1}{4}$.

6. What number subtracted 17 times from 5202 will leave no remainder? *Ans.* 306.

7. Find the greatest common divisor of 91, 56, and 224. *Ans.* 7.

8. A dealer bought 955 melons at \$8.25 a hundred; how much did all cost him? *Ans.* \$78.78.

9. A farmer made 22 $\frac{1}{2}$ bu. wheat per acre on 20 acres; he sold 25% of the crop at \$.85 per bushel; how much did he get? *Ans.* \$95.62.

He sold 66% of the crop at \$.90 per bushel; how much did he get? *Ans.* \$267.30.

10. Find the proceeds of a note of \$750 for 90 days, discounted in bank at 9%. *Ans.* \$732.57.

11. Find the number of square feet in a rectangle 5 yd. long and 3 yd. 9 in. wide. *Ans.* 146 $\frac{1}{4}$ sq. ft.

12. A man bought 600 bu. of corn at \$.50 per bu. and sold the whole for \$250; what per cent did he lose? *Ans.* 16 $\frac{2}{3}$ %.

13. A man sold a horse for \$125, and gained 25%; how much did he pay for the horse? *Ans.* —.

14. Make a receipted bill for 4½ lb. butter at \$.30; 3 doz. eggs at \$.25; 4 lb. cheese at \$.22; 6 lb. honey at \$.12½; and 3 pk. sweet potatoes at \$.25. *Ans.* \$4.48.

15. If in $\frac{3}{4}$ of this month there are 22.5 days, how many days are in $\frac{5}{8}$ of this month? *Ans.* 25 da.

16. Find the difference in acres between 2 square miles and 2 miles square. *Ans.* 1280 A.

17. How many cubic feet in a wall 6 rd. long, 10 ft. high, and 1 ft. 6 in. thick? *Ans.* 1485 cu. ft.

18. Find the cost of digging a cellar 15 ft. by 16 ft. by 8 ft., at \$.75 per cubic yard. *Ans.* \$53.33.

19. If a man earns \$2.25 per day, and works 6 days per week, in how many weeks will he earn \$135? *Ans.* —.

20. After spending $\frac{2}{3}$ of his money, a man has \$10.25; how much did he have at first? *Ans.* —.

21. A farmer has a rectangular field 80 rd. by 50 rd.; he plants 50% of the field in corn, and makes 36 bu. to the acre; how many bushels of corn does he make? *Ans.* 450 bu.

22. Every Sunday a farmer gives 1 pk. of salt to his cows and $\frac{1}{2}$ pk. to his horses; how much salt does he give his cows and horses in a year? *Ans.* 19½ bu.

23. Find in dollars and cents the sum of \$ $\frac{3}{8}$, \$ $\frac{4}{5}$, \$ $\frac{2}{3}$, \$ $\frac{5}{6}$. *Ans.* \$2.67½.

24. Find the highest common factor of 92, 106, and 156. *Ans.* —.

25. Find the interest of a note for \$1505 for 2 yr. 7 mo. 7 da., at 8%. *Ans.* \$313.37.

26. What decimal number is equal to $\frac{3}{4} + \frac{3}{8} + \frac{3}{5} + \frac{3}{10}$? *Ans.* 2.025.

27. How many square rods in a piece of land which produced 247.5 bu. wheat at 22½ bu. per acre? *Ans.* 1760 sq. rd.

28. Add three million six thousand fifty and five tenths, seven hundred thousand and twenty-five thousandths, and two hundred thousand one. *Ans.* 3 906 051.525.

29. How many barrels of flour, of 196 lb. each, are necessary during a leap-year for a city of 49 000 inhabitants, if each person consumes $\frac{3}{4}$ lb. flour per day? *Ans.* 68 625 bbl.

30. If 200 lb. wheat make 150 lb. flour, how many barrels of 196 lb. each could be made from 1 568 bu. wheat of 60 lb. to the bushel? *Ans.* 360 bbl.

31. Find the highest common factor of 72, 96, and 168.

Ans. —.

32. Reduce 350 lb. to the fraction of a ton, represented decimally. *Ans.* .175 T.

33. Subtract the highest common factor of 32, 68, and 1 632 from the least common multiple of 8, 9, 5, and 6.

Ans. 356.

34. Find the difference in yards between $\frac{2}{11}$ of a mile and $\frac{1}{8}$ of a mile. *Ans.* 100 yd.

35. Of a fence a mile long, 40 rd. was swept away by high water; what per cent of the fence was swept away?

Ans. $12\frac{1}{2}\%$.

36. If a locomotive requires 1 T. coal for every 80 miles it runs, how many pounds of coal does it consume in running 365 miles?

Ans. 9 125 lb.

37. What per cent of a common year is gone at midnight of March 14?

Ans. 20%.

38. Divide the highest common factor of 13, 52, and 3 003 by the least common multiple of 2, 5, and 65. *Ans.* $\frac{1}{10}$.

39. Divide the least common multiple of 80, 128, and 208 by their highest common factor. *Ans.* 520.

40. A farmer had a field containing 100 acres, in which he planted an orchard $66\frac{2}{3}$ rd. long and 30 rd. wide; what per cent of the field was the orchard?

Ans. —.

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